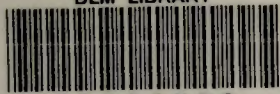
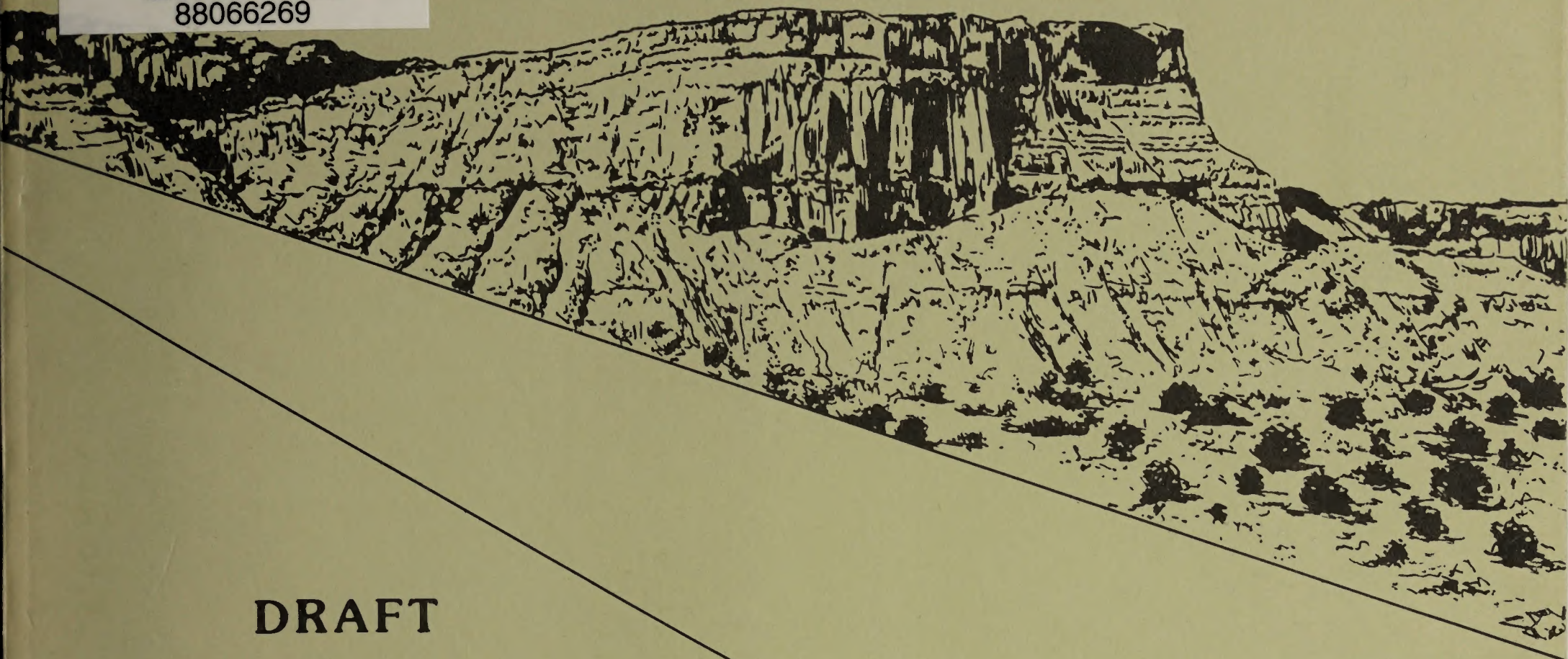


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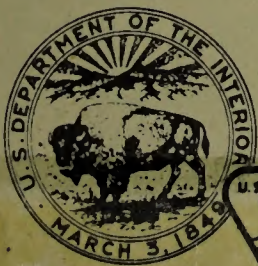


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DRAFT

**ENVIRONMENTAL
ASSESSMENT FOR
COAL PREFERENCE RIGHT LEASING
NEW MEXICO**



UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

ALBUQUERQUE DISTRICT

NOTICE

This draft environmental assessment should be retained to be used in conjunction with the final environmental assessment. The final assessment will incorporate this draft by reference and include modifications and corrections of the draft that are made as a result of public comment. The final statement will also include a record of public comments on this draft and the responses to those comments.

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PREFACE

SAN JUAN BASIN ACTION PLAN

The BLM is responsible for the management of much of the land and mineral resources in the San Juan Basin, and currently has seven separate but interrelated projects proposed or ongoing that will require BLM approval or disapproval.

Project	Environmental Document
Coal Preference Right Lease Applications	EA
Ute Mountain Land Exchange	EA
Accelerated Wilderness Study Areas	EIS
San Juan River Regional Coal Leasing	EIS
New Mexico Generating Station	EIS
Bisti Multiple Resource Program	EA
Bisti Badlands Lease Exchange	EA

In order to consider these actions and make decisions that best represent the public interest and the natural resources, the BLM has developed the San Juan Basin Action Plan. This plan lays out the decision-making process and the means of complying with applicable laws in a timely manner. It proposes the preparation of environmental analyses on the above projects to assess the site-specific and cumulative effects of the various proposed actions. Furthermore a cumulative overview will be prepared and provided as a supplement to each of the EISs.

This EA on the Preference Right Leasing in New Mexico is the first of the series in the schedule.

ENVIRONMENTAL ASSESSMENT FOR COAL PREFERENCE RIGHT LEASING NEW MEXICO

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chapter 1

PROPOSED ACTION & ALTERNATIVES

CHAPTER 1

PROPOSED ACTION AND ALTERNATIVES

DESCRIPTION OF THE PROPOSED ACTION

The Proposed Action is to issue leases for the purpose of mining coal. This involves the offering of 75,510 acres of public, Indian, state, and private lands underlain by federal coal, for 26 Preference Right Leases (refer to Table 1-1 and Map 1-1). Appendix A-1 lists the application number, acreage, and legal description for each Preference Right Lease Application (PRLA). Hereafter, this area is referred to as the PRLA Area. (Refer to Map 1-2 for location.)

This acreage includes approximately 22,000 acres that would be mined by surface methods and approximately 26,650 acres that would be mined by underground methods (refer to Map 1-3). These figures are based on the assumption that surface mining methods would be used to recover coal to the 250-foot depth and underground methods would be employed to recover coal reserves beyond the 250-foot depth. For detailed information on mining methods, refer to Appendix A-2.

The PRLAs adjoin competitive coal lease application NM-19986 held by Sunbelt Mining Company and existing federal coal lease NM-10931 held by Eastern Coal. Other existing federal coal leases in the area are NM-0186612, NM-0186613, and NM-0186615 held by Sunbelt Mining Company, and NM-2457 held by Thermal-Peabody. Some fee coal leases also adjoin the PRLAs (Map 1-4). A description of Preference Right Lease Applications and the leasing process are discussed in this chapter under the headings of "Purpose of and Need for the Action" and "Authorizing Actions".

This environmental assessment will be used to develop the stipulations to be attached to the lease, if issued. After review of the stipulations, the applicants will determine if they can economically mine coal. If they determine that they can do so, they will submit their final showing, as defined in 43 CFR 3430.4-1 (d): "The information submitted by the applicant shall be sufficiently detailed to determine whether the applicant's showing (1) has a reasonable factual basis, (2) supports the applicant's assertion that the proposed lease contains commercial quantities of coal . . ." Any areas that contain commercial quantities of coal that are found to be unacceptable for leasing because of environmental reasons will not be leased.

NO ACTION ALTERNATIVE

The No Action Alternative considers that no federal leases would be granted. This would essentially constrain coal development in the area with the exception of the existing coal leases and development of state and private coal. No environmental impacts would affect public lands or resources if the No Action Alternative was selected.

If, in the final analysis of the proposed lease areas, it is determined that (1) commercial quantities of coal are not present, or (2) the public interest would not be served because of adverse environmental impacts, the No Action Alternative will be chosen.

TABLE 1-1

PRLA ACREAGE BY SURFACE LAND STATUS

PRLA Number	Acres				Totals
	Public Land	State Land	Indian Land	Indian ^a / Withdrawal	Private Land
NM-585	2,048		763		2,811
NM-3752	3,085		515	160	3,760
NM-3753	1,159	672	800		2,951
NM-3754	1,555			1,520	3,075
NM-3755	1,468		1,120		2,588
NM-3834	4,591		213		4,804
NM-3835	1,325	2,215	960		4,500
NM-3836	3,830	1,280			5,110
NM-3837	4,800		320		5,120
NM-3838	4,321		466		4,787
NM-3918	4,477				4,477
NM-3919	4,478				4,478
NM-6801	43		4,351		4,394
NM-6802	340				340
NM-6803	4,961		160		5,121
NM-6804	1,602				1,602
NM-7235				160	160
NM-8128	1,333	680	1,040	1,446	4,499
NM-8129	1,520				1,520
NM-8130	973		280	880	2,133
NM-8715	640		960	321	1,921
NM-8717	320		280		600
NM-8745	320		200		520
NM-9764	40		200		240
NM-11670	639	480			1,119
NM-11916	320		2,560		2,880
TOTALS	50,188	5,327	15,188	4,487	320
					75,510

Note: ^a/ Public Land Order 2198 Lands.

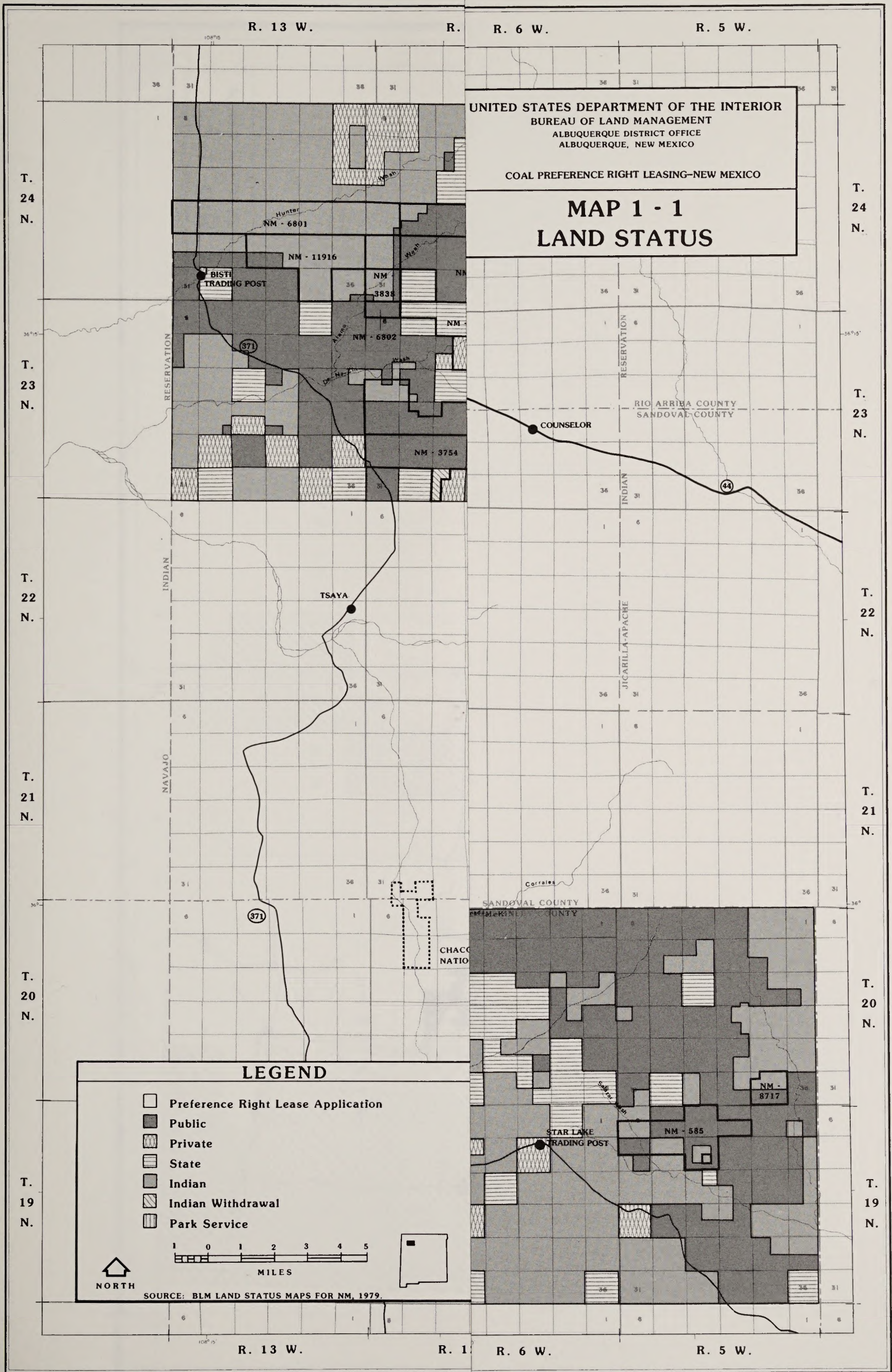


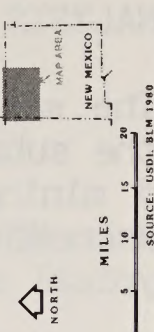
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NM-3838	4,321		466		
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NM-3919	4,478				
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NM-6802	340				
NM-6803	4,961		160		
NM-6804	1,602				
NM-7235				160	
NM-8128	1,333	680	1,040	1,446	
NM-8129	1,520				
NM-8130	973		280	880	
NM-8715	640		960	321	
NM-8717	320		280		
NM-8745	320		200		
NM-9764	40		200		
NM-11670	639	480			
NM-11916	320		2,560		
TOTALS	50,188	5,327	15,188	4,487	320
					75,510

Note: ^a/ Public Land Order 2198 Lands.

**PREFERENCE RIGHT
LEASE APPLICATIONS
(P.R.L.A.)**



SCOPE OF ANALYSIS

The scope of analysis is based on the federal action of leasing the PRLAs and the subsequent development of the coal reserves. Typical surface and underground mining operations are described in Appendix A-2. This environmental assessment (EA) addresses the known impacts that would result from mining by these typical surface and underground methods.

The leasing of PRLAs is a phased process. This EA assesses the impacts to PRLA acreages using the information submitted by the applicants in response to the initial showing requirement. Recommended mitigation in the Draft EA will be further developed into stipulations, terms and conditions in the Final EA. The applicants will be made aware of these stipulations and will use them in determining their final showings. Leases will be issued if the applicants demonstrate they can meet the final showing requirements while applying the stipulations, and if the U.S. Geological Survey (USGS) determines there are commercial quantities of coal. Subsequently, the applicants will submit mining plans as required by the Office of Surface Mining (OSM), and site-specific environmental analyses will be prepared using the highly detailed data included in the mining plans. These more intense and specific analyses would assess impacts of mining-related activities that are beyond the level of detail analyzed in this EA. These analyses will undergo the same public review procedures as this EA.

ASSUMPTIONS

A series of assumptions have been developed based on material and data submitted by the applicants to meet the initial showing requirement, subsequent coordination with and confirmation by the applicants, and close consultation with the USGS. These assumptions were developed and are listed below and in Table 1-2 to aid the reader in interpreting the magnitude of anticipated impacts. They also provide a base for future analysis of potential impacts if development takes place. The federal coal on the PRLAs is combined into logical mining units with state and private coal. For the purposes of this analysis, acreage figures have been aggregated for each applicant's group of PRLAs as shown in Table 1-2 (refer also to Map 1-3).

1. Additional exploratory drilling would be needed to obtain more detailed information about the coal deposits underlying the PRLA Area.
2. The Star Lake Railroad, including spurs and loops, would be available to transport the coal (refer to Map 1-2).
3. Power would be delivered by the Fruitland Coal Load Transmission Line (refer to Map 1-2).
4. There would be zero discharge from point sources to waterways at support facility sites.
5. Haul roads, utility easements, and other associated facilities would undergo impact analysis as rights-of-way applications were received. It would not be until applications were submitted that specific locations, alignment and other right-of-way information would be developed by applicants meeting the final showing requirements.
6. Production would begin within 10 years of the issuance of a lease.



United States Department of the Interior

IN REPLY REFER TO

1792 (015)

BUREAU OF LAND MANAGEMENT

3550 Pan American Freeway, N.E.

P.O. Box 6770

Albuquerque, New Mexico 87107

JUN 5 1981

Dear Sir or Madam:

This Draft Environmental Assessment for Coal Preference Right Leasing, has been developed by the Albuquerque District Office, Bureau of Land Management, in accordance with the Council on Environmental Quality Regulations for the National Environmental Policy Act (40 CFR 1500-1508).

There will be a 40-day public review period from June 8, 1981 to July 17, 1981. You are invited to comment on the adequacy of this draft document. Oral and written comments can be presented during the following public meetings.

Pueblo Pintado	Chapter House	July 7, 1981	10:00 a.m. - 5:00 p.m.
Lake Valley	Chapter House	July 8, 1981	10:00 a.m. - 5:00 p.m.
Huerfano	Chapter House	July 9, 1981	10:00 a.m. - 5:00 p.m.
Albuquerque	Convention Center	July 13, 1981	3:00 p.m. - 9:00 p.m.
	401 2nd, NW Acoma Room		
Taos	Kachina Lodge	July 15, 1981	3:00 p.m. - 9:00 p.m.
	N. Pueblo Road Sundance Room		
Farmington	The Inn	July 16, 1981	3:00 p.m. - 9:00 p.m.

If you wish to present oral comments, contact Jeff Radford, Public Information Officer at the Bureau of Land Management, Albuquerque District Office [telephone (505) 766-2455] by July 1, 1981.

Written comments may also be mailed or submitted in person to:

L. Paul Applegate, District Manager
Bureau of Land Management
3550 Pan American Freeway, NE
P. O. Box 6770
Albuquerque, New Mexico 87107

Comments must be received by the close of business on July 17, 1981 in order to be considered in the preparation of the final environmental assessment. Responses to oral and written questions addressing the adequacy of the assessment will be included in the final document.

I look forward to receiving your comments, and thank you for your interest and participation.

Sincerely yours,

L. Paul Applegate
Acting

L. Paul Applegate
District Manager

ERRATA

The following information is to be combined with the socioeconomic section.

The PRLA Area is located to the east of the Navajo Reservation boundary where a traditional use of the surface has been primarily that of livestock grazing by local ranchers. More recently oil and gas development has occurred. The complex surface ownership pattern is comprised primarily of public land and Indian allotted lands with some private lands. The mineral estate has similar complexity inasmuch as there are cases where federal coal underlies private or Indian allotted surface. Over the years Navajo occupancies were developed in the area for a variety of reasons, the primary ones, however, were to be closer to either their livestock or areas of traditional sacred practices.

At the present time, there are several Navajo occupancies of public lands in the PRLAs. The information regarding occupancies and their locations shown in the attached table was gathered during an inventory of the coal lands in northwestern New Mexico in 1980-1981.

Congressional legislation, Executive Orders, and Department of Interior Land Orders, since the Navajos signed the Treaty of 1868, have been attempting to consolidate the land holdings of the Navajo Tribe. However, the Navajos have occupied public lands which they consider as their homeland and upon which the Bureau of Land Management has administrative jurisdiction.

Recognizing the historical nature of the problem, the complexities of conflicting land claims and the needs of the people who occupy public land in and around the PRLAs, the BLM, BIA, and the Navajo Tribe, as per Memorandum of Understanding #NMSO-110, 1979 recognized the following methods as possible vehicles for resolving those occupancies of public lands:

- A. Voluntary relocation to non-BLM lands
- B. Purchase of the occupant's equities outright
- C. Mandatory relocation to non-BLM lands
- D. Purchase of BLM lands
- E. Purchase of non-BLM lands
- F. Exchange
- G. Lease
- H. Life Estate
- I. Permit (License)
- J. Temporary relocation until mining and rehabilitation is completed
- K. Stipulation in future mineral lease to require mining interest to handle
- L. Relocation to land in the Navajo-Malpais exchange

It is the agreement and understanding of the parties trying to resolve the occupancies, that the above-described methods of solution may, and most probably will, differ from one case to the other.

As mining plans are developed and if the PRLA applicants meet the final showing requirements more detailed and definitive plans will be provided to determine which occupancies will be affected and to what degree.

OCCUPANCY SITES IN THE PRLA AREA

Site	PRLA No.	Strippable Coal	Underground Coal	Near Strippable/Unstrippable Boundary
T. 19 N., R. 5 W.,				
Sec. 3, SE ¹ / ₄ (Occupied Site)	NM-585	X		
SW ¹ / ₄ (Occupied Site)	NM-585	X		
Sec. 4, NE ¹ / ₄ (Ancillary Site)	NM-585	X		
Sec. 6, SW ¹ / ₄ (Occupied Site)	NM-585	X		
Sec. 9, (Occupied Site)	NM-585	X		
T. 20 N., R. 7 W.,				
Sec. 3, NE ¹ / ₄ (Occupied Site)	Not on PRLA			
SE ¹ / ₄ (Occupied Site)	NM-8715			X
Sec. 6, NE ¹ / ₄ NW ¹ / ₄ (Ancillary Site)	NM-8130	X		
T. 20 N., R. 8 W.,				
Sec. 1, SW ¹ / ₄ (Ancillary Site)	NM-8130	X		
Sec. 2, NE ¹ / ₄ (Occupied Site)	NM-8130	X		
Sec. 12, NE ¹ / ₄ (Occupied Site)	NM-8130	X		
T. 21 N., R. 8 W.,				
Sec. 10, SE ¹ / ₄ SE ¹ / ₄ (Occupied Site)	NM-8128		X	
Sec. 15, NW ¹ / ₄ NW ¹ / ₄ (Occupied Site)	NM-8128			X
Sec. 22, SW ¹ / ₄ (Seasonal Use Site)	NM-8128	X		
Sec. 25, SW ¹ / ₄ (Ancillary Site)	NM-8128	X		
Sec. 34, W ¹ / ₂ SE ¹ / ₄ (Occupied Site)	NM-8128	X		
E ¹ / ₂ SW ¹ / ₄ (Occupied Site)	NM-8128	X		
T. 22 N., R. 10 W.,				
Sec. 17, SW ¹ / ₄ (Occupied Site)	NM-3918	X		
Sec. 18, SE ¹ / ₄ (Abandoned Site)	NM-3918	X		
Sec. 19, SW ¹ / ₄ (Site not currently used)	NM-3918	X		
Sec. 23, SE ¹ / ₄ (Occupied Site)	NM-3918	X		
Sec. 24, SW ¹ / ₄ (Occupied Site)	NM-3918	X		
NW ¹ / ₄ (Occupied Site)	NM-3918	X		
T. 23 N., R. 11 W.,				
Sec. 11, SE ¹ / ₄ SE ¹ / ₄ (Abandoned Site)	NM-6803		X	
T. 23 N., R. 12 W.,				
Sec. 18, SE ¹ / ₄ (Abandoned Site)	NM-3752	X		
T. 24 N., R. 13 W.,				
Sec. 20, NE ¹ / ₄ (Site not currently used)	NM-6801		X	

Notes: Occupied Site: A site that is currently occupied.

Ancillary Site: A site containing non-habitation facilities such as windmills, corrals, etc.

Site not currently used: A site that is not currently occupied, but by appearances could be occupied in the future.

Abandoned Site: A site that has been abandoned but by appearances is not likely to be occupied in the future.

Seasonal Use Site: A site known to be occupied at certain times of the year.

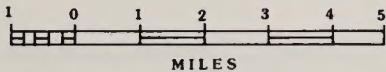
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
ALBUQUERQUE DISTRICT OFFICE
ALBUQUERQUE, NEW MEXICO

COAL PREFERENCE RIGHT LEASING-NEW MEXICO

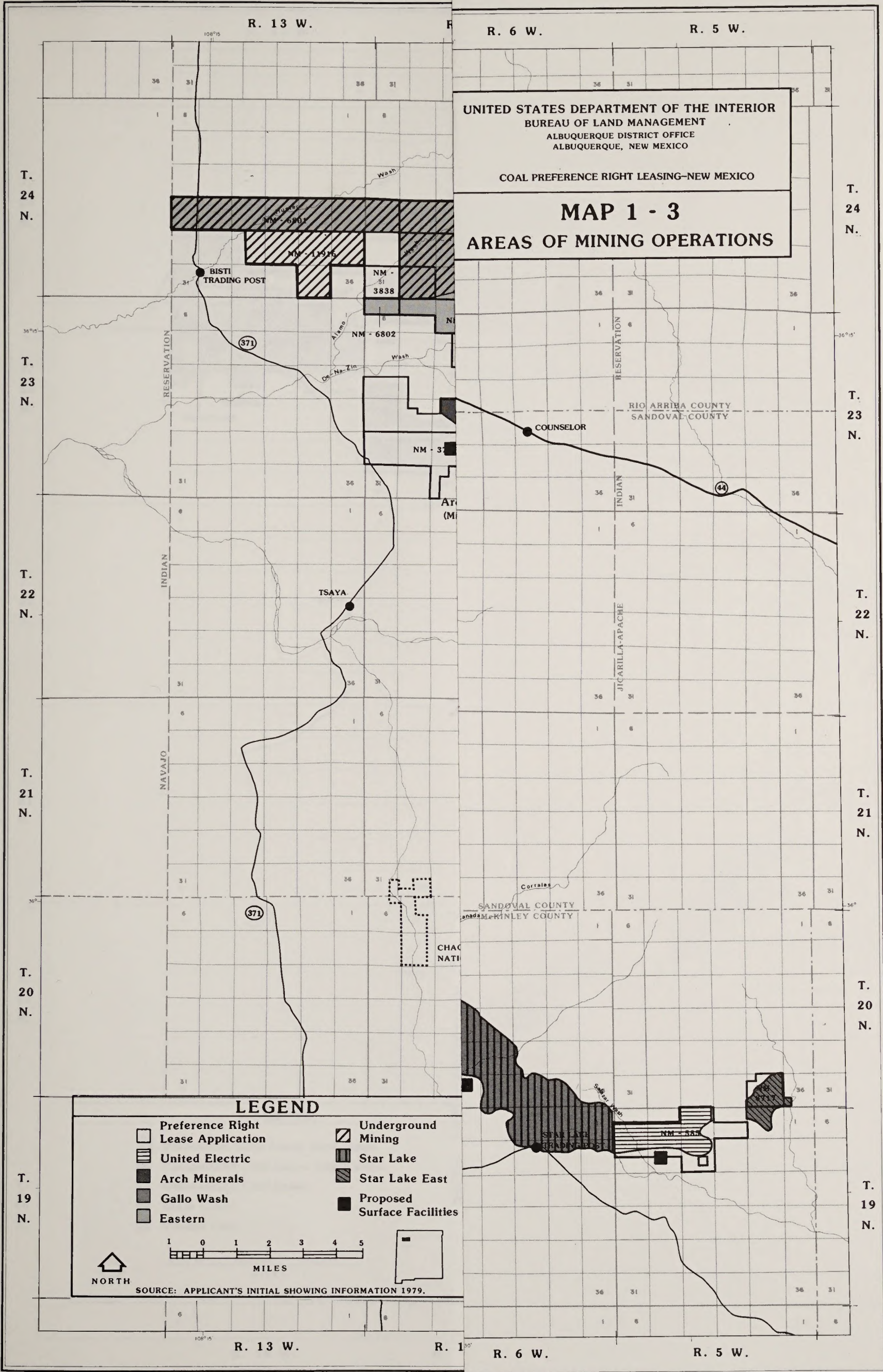
MAP 1 - 3 AREAS OF MINING OPERATIONS

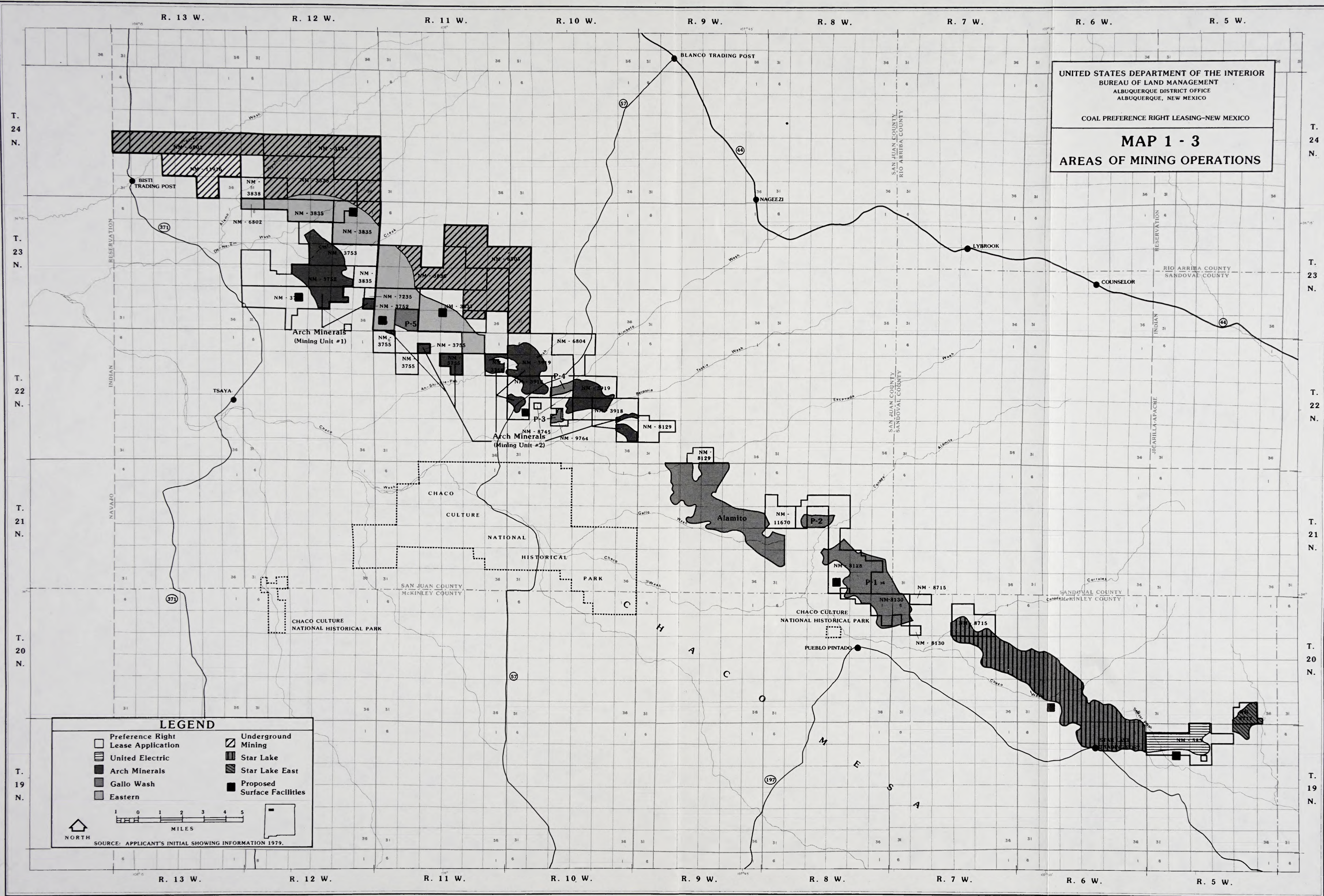
LEGEND

- | | |
|------------------------------------|-----------------------------|
| Preference Right Lease Application | Underground Mining |
| United Electric | Star Lake |
| Arch Minerals | Star Lake East |
| Gallo Wash | Proposed Surface Facilities |
| Eastern | |



SOURCE: APPLICANT'S INITIAL SHOWING INFORMATION 1979.





UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
ALBUQUERQUE DISTRICT OFFICE
ALBUQUERQUE, NEW MEXICO

COAL PREFERENCE RIGHT LEASING-NEW MEXICO

MAP 1 - 3
AREAS OF MINING OPERATIONS

LEGEND

Preference Right Lease Application	Underground Mining
United Electric	Star Lake
Arch Minerals	Star Lake East
Gallo Wash	Proposed Surface Facilities
Eastern	

NORTH

0 1 2 3 4 5 MILES

SOURCE: APPLICANT'S INITIAL SHOWING INFORMATION 1979.

R. 5 W.

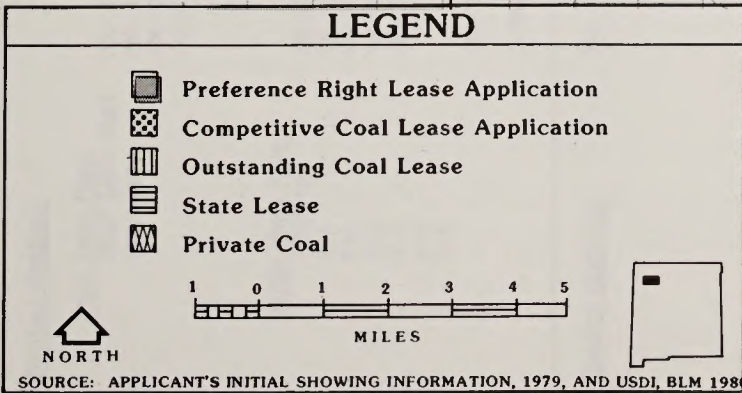
COAL PREFERENCE RIGHT LEASING-NEW MEXICO

MAP 1 - 4

AREAS OF COAL INTEREST

T.
19
N.

T.
19
N.



R. 5 W.

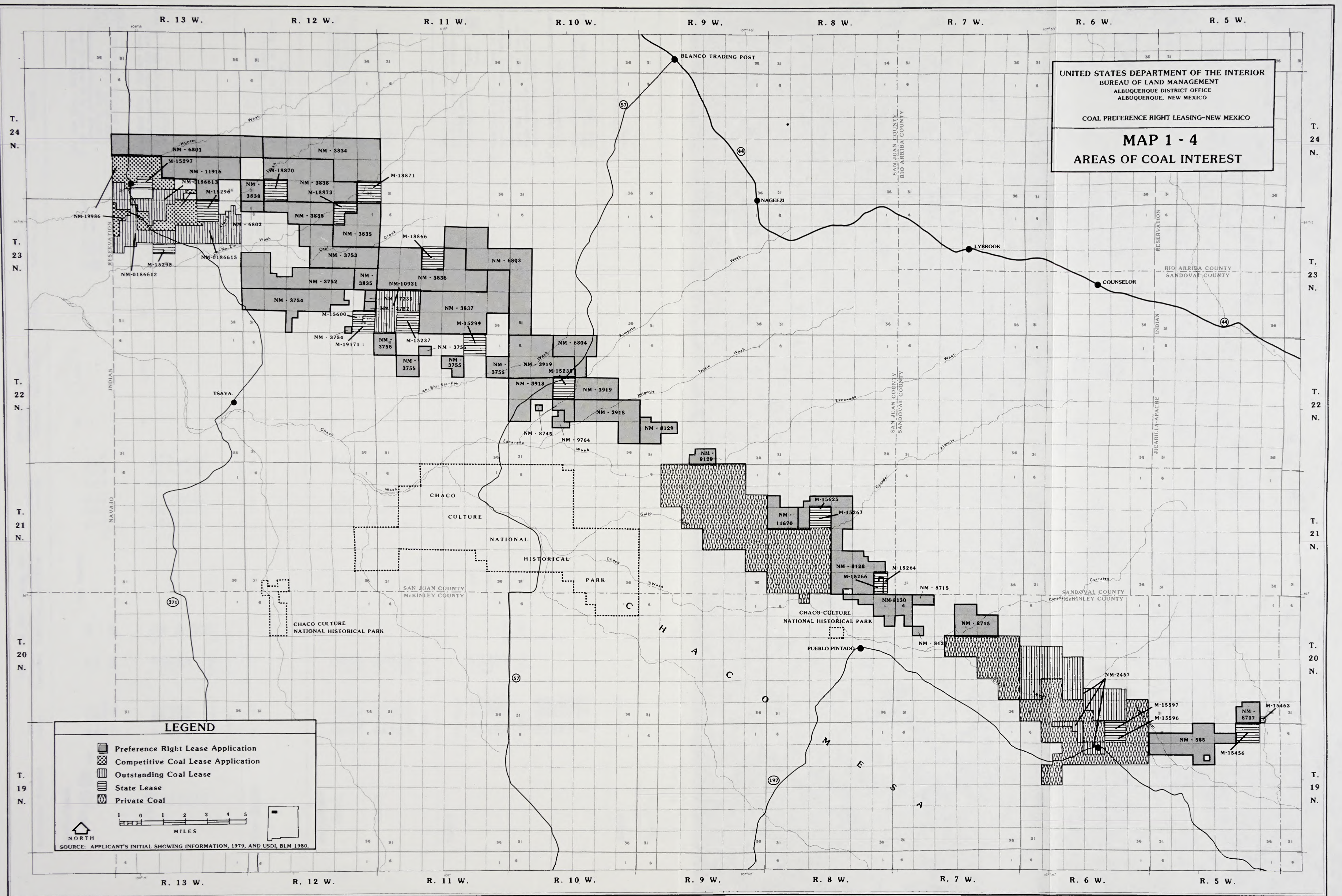


TABLE 1-2

ASSUMPTIONS

Applicants' Proposal	PRLA Number	PRLA Acreage Disturbed	Non-PRLA Acreage Disturbed	Acreage for Mine Support Facilities	General Location	Estimated Mine Life (Years)	Water Requirements (ac.ft./yr.)	Employment Estimate	Coal Production (million tons)	Remarks
Thermal-Peabody										
Star Lake Mine Star Lake East Star Lake	NM- 8717	480	320	(see Remarks)	T. 20 N., R. 5 W.	40	1,000+	250	11 Star Lake East 245 Star Lake 256 Total	Star Lake Mine - Surface mine a/ NM- 2457 is an existing lease. Acreage disturbance breakdown: Existing lease 3,970 Other private or state 5,145 Mine facilities (off-lease) 125 Total 9,240
	NM- 8715	560			T. 20 N., R. 7 W.					
	NM- 2457a/				T. 19-20 N., R. 6-7 W.					
	Subtotals	1,040	320							
Gallo Wash Mine Alamito	NM-11670	80	4,815	125b/	T. 21 N., R. 8-9 W.	40	1,000+	480	252 Alamito, P-1-3 37 P-4-5 289 Total	Gallo Wash Mine - Surface mine b/ Mine support facilities would cover 100 acres off PRLA, 25 acres on PRLA.
	NM- 8130	1,580	990		T. 20-21 N., R. 7-8 W.					
	NM- 8128	1,680			T. 20-21 N., R. 7-8 W.					
	NM- 8128	220	320		T. 21 N., R. 8 W.					
	NM- 9764	190	400		T. 22 N., R. 10 W.					
	Subtotals	3,750	7,125		T. 22 N., R. 10 W.					
	TOTALS	4,790	7,445		T. 23 N., R. 11 W.					
United Electric										
	NM- 585	1,700		125c/	T. 19 N., R. 5 W.	20	650	200	59 (2 first yr, 3/yr for remaining 19 yrs)	One surface mine. c/ Mine facilities on PRLA. Would relocate: 16 inch oil pipeline, Gas Co. of New Mexico gas line, water line, Jemez Electric powerline.
Arch Minerals										
Unit #1	NM- 3754	700		40d/	T. 23 N., R. 12 W.	40	2,500	400	200 (5/yr)	Units 1 and 2 -- surface mines. May possibly begin production by 1985. Power would come from Fruitland Coal Load Transmission Line. d/ Mine facilities located on the PRLA.
	NM- 3753	1,180			T. 23 N., R. 12 W.					
	NM- 3752	1,620		40	T. 23 N., R. 12 W.					
	Subtotals	3,500								
Unit #2	NM- 3918	1,900		40d/	T. 22 N., R. 10 W.	40	2,500	400	200 (5/yr)	
	NM- 8745	60			T. 22 N., R. 10 W.					
	NM- 3919	1,900			T. 22 N., R. 11 W.					
	NM- 3755	940		40						
	Subtotals	4,800								
	TOTALS	8,300		80						
Eastern										
	NM-10931e/					30/mine	5,000 (3 mine support facilities)	250	350 (7/yr)	e/ NM-10931 is an existing lease. Acreage disturbance breakdown: Existing lease 1,785 Mine facilities (on lease) 125 Total 1,910
	NM- 3837f/	1,655		125g/						f/ Remaining PRLAs involved in 2 surface mines. Support facilities located on the existing lease (see Map 1-3). Second mine to begin operation 5 years after opening of first mine. g/ Mine support facilities developed for underground mines. h/ PRLA involved in underground mining. Total acres mined on all seven PRLAs - 23,895.
	NM- 3836f/	1,920								
	NM- 3835f/	3,255		125g/						
	NM- 6802f/	340								
	NM- 3838f/	60	1,040							
	TOTALS	7,230	1,040	250						
	NM- 3834h/									i/ One underground mine - 2,755 acres.
	NM- 3835h/									
	NM- 3836h/									
	NM- 3837h/									
	NM- 3838h/									
	NM- 6801h/									
	NM- 6803h/									
Kin-Ark	NM-11916i/			125		25	200	450	50 (2/yr)	
GRAND TOTALS		22,020	8,485	705			12,850	2,430	1,404	

Source: Applicants' initial showing information 1979.

cations are considered as separate actions and will be subject to specific environmental analyses prior to issuance. Table 1-3 lists those measures that applicants would have to comply with.

MONITORING

A monitoring plan will be developed from the mining and reclamation plan and from the developed stipulations, terms, and conditions attached to the leases. The plan will be carried out by BLM field personnel and will be under the responsibility of the District Manager, Albuquerque District Office.

RECLAMATION POTENTIAL

Post-mining use of the PRLA Area has not specifically been designated by the BLM. Because the maximum mine life is projected to be 40 years, it is not feasible to determine a specific use that far in the future. At this time the post-mining use is assumed to include the present uses of livestock grazing, wildlife habitat, and recreation. Surface reclamation and restoration will be under the guidance and supervision of OSM (30 CFR 715).

Soils and water characteristics and availability are the most important factors for successful reclamation. The Federal Surface Mining Control and Reclamation Act of 1977 and the New Mexico Surface Mining Act of 1979 require that permanent vegetative cover capable of self-regeneration at least equal in extent to natural vegetation be established on disturbed areas. In some areas such as badlands, productivity may potentially be greater after successful reclamation.

Reclamation of all disturbed areas would be difficult because of the arid climate and the nature of the soils present. Successful revegetation would depend upon good seedbed preparation, moisture at the correct time, and other variables. Current reclamation techniques such as redistributing topsoil have only been in use a few years. Sufficient information is not available for the immediate PRLA Area on the amount of time necessary for native vegetation reestablishment. However, successful reclamation has been experienced at nearby strip mining operations at the Navajo Mine and the McKinley Mine.

INTERRELATIONSHIPS WITH EXISTING ENVIRONMENTAL DATA

Analysis of the impacts of mining coal on the resources of the PRLA Area was included in the Star Lake-Bisti Regional Coal EIS (#FES-INT-79-11) in the scenario for high-level coal development. Impacts of uranium development are discussed along with potential impacts from other resource development in the final edition of Uranium Development in the San Juan Basin Region, 1980 prepared by the Bureau of Indian Affairs (BIA).

Comprehensive land-use planning for public lands is required by FLPMA. The concept of multiple resource management is fundamental to the BLM's planning system for public lands. The BLM uses resource data from a combination of administrative and geographical planning units to develop management framework plans (MFPs). An MFP is a planning document that establishes coordinated land-use allocations for all resources, as well as objectives and constraints for each resource and support activity.

Resource	Mitigation Required by Law and Regulation	How Mitigation is Accomplished
Air Quality	P.L. 95-95	Specifies federal air quality standards that cannot be violated.
	New Mexico Air Quality Control Regulation 201	Specifies standards not to be equalled or exceeded.
	New Mexico Air Quality Standards and Regulation, Section 672	Coal handling equipment will be equipped to prevent particulate matter from becoming airborne. Haul roads will be sprayed to prevent particulate matter from becoming airborne.
	30 CFR 817.95 (OSM)	Each underground operator will employ fugitive dust control measures.
	30 CFR 784.26 (OSM)	Operators will establish monitoring systems for evaluation of dust control programs.
	43 CFR 3465 (BLM)	Operators will use mining methods to prevent or control surface subsidence to maintain value and use of surface lands. Disturbed areas will be contoured and regulated after exploration.
	30 CFR, Part 816	Permanent Program Performance Standards -- Surface Mining Activities.
	30 CFR, Sections 816.21 through 816.25	Topsoil removal, storage, redistribution, and soil amendments.
	30 CFR, Sections 816.41 through 816.57	Hydrologic balance, sediment control, impoundments, acid spoils, and stream buffer zones.
	30 CFR, Sections 816.71 through 816.74	Disposal of excess spoil material.
Topography and Geology	30 CFR, Sections 816.101 through 816.106	Backfilling, grading, and rill stabilization.
	30 CFR, Sections 816.111 through 816.117	Revegetation.
	30 CFR, Sections 211.30 through 211.36	Regulations pertaining to underground mining.
	30 CFR, Sections 211.40 and 211.41	Reclamation and performance standards for surface mining.
	Dept. of Interior Policy	The Conservation Division of U.S. Geological Survey will determine priority of development between coal, oil, and gas. Future uranium mineral claimants will coordinate with coal lessee. Unresolved conflicts will be settled in court.
	16 U.S.C. 431-433	Collection of vertebrate fossils prohibited.
	Federal Land Policy and Management Act Section 102 (a)(8)	It is FLM policy to determine mitigation or protection stipulations for paleontology on a case-by-case basis. Clearances will be required for all surface-disturbing activities on the PRLAS to avoid unnecessary destruction or disruption of fossils and collecting sites. Important sites will be salvaged.
	BLM Washington Office Instruction Memorandum 79-111 (Nov. 29, 1978)	Coal mining operations will be monitored and BLM notified if fossils are discovered.
	State of New Mexico Senate Memorial 31	Mining operators on state lands will notify the State of New Mexico, Dept. of Finance and Administration, Office of Cultural Affairs, if important fossils are found.
	30 CFR 211.40 (USGS)	Roads will be built to minimize erosion and contamination of soil. Drill site and ventilation shafts will be backfilled. Disturbed areas will be regraded and revegetated.
Soils		
Water Resources	Clean Water Act of 1977	Environmental Protection Agency will grant National Pollutant Discharge Elimination System Permits specifying discharge water quality standards.

TABLE 1-3 (Cont'd)

Resource	Mitigation Required by Law and Regulation	How Mitigation is Accomplished
Water Resources (Cont'd)	30 CFR 817.42 (OSM)	Restricts pollutant discharge.
	30 CFR 817.45 150-176 (OSM)	Amount of sediment produced will be minimized by conformance.
	30 CFR 817.54 (OSM)	Disrupted water supplies will be replaced.
	30 CFR 817.121 (OSM)	Mining will be conducted to minimize surface damage.
	N.M. Stat. Annot. (1953 Compil.) Section 75-21	As a means of conservation, the State Engineer of New Mexico supervises, measures, appropriates and distributes state waters.
	Federal Water Pollution Control Act of 1972, as amended (33 U.S.C. 1251 et. seq.)	Established water quality standards adopted by N.M. Water Quality Control Commission and approved by Environmental Protection Agency.
Vegetation	Federal Surface Mining Control and Reclamation Act of 1977; New Mexico Surface Mining Act of 1979; New Mexico Coal Surface Mining Commission, Rule 78-1, Section 37; 30 CFR 817. 111-117 (OSM)	Diverse and permanent vegetative cover capable of self-regeneration at least equal in extent to natural vegetation will be established on affected areas.
Wildlife	Endangered Species Act of 1973 (87 Stat. 884; 16 U.S.C. 1531-1543, as amended)	Consultation with U.S. Fish and Wildlife Service will take place if endangered species are involved.
	Bald Eagle Protection Act of 1969 (U.S.C. 668-668.)	Mining operations and rights-of-way would not be permitted where bald or golden eagles or their nests would be disturbed.
	30 CFR 817 (OSM)	Required restoration of soils and vegetation allows wildlife to repopulate area upon completion of mining and removal of surface facilities.
	N.M. Regulation, 563, as amended.	The New Mexico State Department of Game and Fish is responsible for state endangered species and subspecies.
Visual Resources	30 CFR 211.30 (USGS)	Requires maximum recovery of coal, consistent with protection of other natural resources.
	30 CFR 211.31(a) (USGS)	Each operator will adopt measures to prevent or control subsidence.
	30 CFR 211.41(c) (USGS)	Methods of abandonment may include regrading and revegetation. Equipment and structures will be removed without delay.
	30 CFR 717.14(a) (OSM)	Disturbed work areas will be regraded to approximate original contour upon completion of mining.
	30 CFR 817.111-117 (OSM)	Specifies revegetation requirements.
Wilderness	43 U.S.C. 1701 et seq., Section 603	Access across public lands under review for wilderness is granted by the Secretary only when it would not impair suitability of the area for that designation.
	30 U.S.C. 1201 et seq., Section 522	Federal lands shall be considered unsuitable for mining of coal while under review by the Administration and Congress if possible wilderness designation.
Recreation	30 CFR 211.4(d) (USGS)	Operator will minimize, control, or prevent damage to recreational values.
	30 CFR 211.40(a)(1) (USGS)	Reclamation will be pursuant to an approved plan to restore pre-mining uses of lands.
	30 CFR 211.40(a)(14) (USGS)	Public access on lease area for lawful activities will be allowed, with minor exceptions.

TABLE 1-3 (Concluded)

Resource	Mitigation Required by Law and Regulation	How Mitigation is Accomplished
Recreation (Cont'd)	30 CFR 211.41(c) (USGS)	Excavations will be closed and backfilled in accordance with sound engineering practices.
Transportation	30 CFR 817.124 (OSM)	Rights-of-way will be protected.
Grazing	30 CFR 817.111-117 (OSM); New Mexico Coal Surface Mining Commission, Rule 78-1, Section 37	Diverse and permanent vegetative cover capable of self-regeneration at least equal in extent to natural vegetation will be established on affected areas.
	30 CFR 817.13 (OSM)	Exposed underground openings will be managed to ensure safety of people and livestock.
	30 CFR 817.54 (OSM)	Disrupted water supplies will be replaced.
Land Status	43 U.S.C. 1712	Valid existing rights will be identified and protected in BLM land-use plans.
Cultural Resources	P.L. 96-515 16 U.S.C. 431-433; 16 U.S.C. 461-467; 16 U.S.C. 469a; 16 U.S.C. 470; 30 U.S.C. 3A and 7; 30 U.S.C. 181; 30 U.S.C. 351 et seq.; 30 U.S.C. 1201 et. seq; 42 U.S.C. 1996; 42 U.S.C. 4321-4347; 43 U.S.C. 1701-1771; 36 CFR 62; 36 CFR 63; 36 CFR 800; 40 CFR 1500; 40 CFR 1508; 43 CFR 34-30; 43 CFR 3461.1 (g); MOA; BLM and State of NM (1977); FMOA: DOI-BLM, OSM, USES and ACHP (1980).	A lessee will be required to carry out intensive field inventories of cultural resources on uninventoried portions of the area that may be affected by lease-related activities, and develop mitigation measures that include, as appropriate, provisions for data recovery, curation, detailed recordation, stabilization, and relocation to provide appropriate levels of protection from adverse effects for specific properties. The complete text of this agreement is contained in Appendix A-4.
Socioeconomic Conditions	New Mexico Severance Tax Act	Tax of \$.38/ton will be paid on steam coal.
	Mineral Leasing Act of 1920; Coal Leasing Act of 1976	Fifty percent of royalties from federal coal will be returned to the state.

UNSUITABILITY CRITERIA

On June 1, 1979, final criteria to determine lands unsuitable for coal mining were selected by the Department of the Interior. The criteria are being applied during the BLM's concurrent development of the land use plan for PRLA Area. Criteria 2, 3, 4, 6, 7, 9, 11, 12, 13 and 15 may be expected to result in the determination of unsuitability of all or portions of some PRLAs. Lands deemed unsuitable are to be conditioned through lease stipulations, but are not to be excluded from the lease. It is expected that final determination of unsuitability will be completed in time for inclusion in the Final EA. Unsuitability criteria relevant to the PRLAs are found in Title 43 CFR 3461.1 (a)(1) through (t)(1) and are listed in Appendix A-3.

PURPOSE OF AND NEED FOR THE PROPOSED ACTION

The purpose of and need for the proposed leasing action is to respond to the preference indicated by industry for mining coal in the specific areas covered by the PRLAs. Until the early 1970's, the federal government issued prospecting permits to interested parties to explore for coal in areas where workable deposits were not known to exist. By demonstrating that the permit area contained commercially valuable coal, a prospecting permit holder could apply for and obtain a lease to mine the deposit. Such lease applications were called Preference Right Lease Applications (PRLAs), and leases were issued without competition. Under the Federal Coal Leasing Amendments Act of 1976 (FCLAA), such noncompetitive coal leases are no longer permitted, subject to valid existing rights.

Under the new federal coal management program, a company with a pending application for a Preference Right Lease shall be entitled to a non-competitive coal lease if the applicant can demonstrate that commercial quantities of coal on the prospecting permit lands were discovered within the term of the permit, other requirements having been met. As a matter of policy, the Department of the Interior (DOI) will complete the processing of all Preference Right Lease Applications by December 1, 1984.

PRLA processing steps involve:

1. Initial showing. The applicant must submit to the BLM the quantity and quality of the reserves discovered within the boundaries of the prospecting permit.
2. PRLAs will be processed in the cycle of ongoing comprehensive land use plans. If the applicant can show that processing the application in the normal cycle of land use planning will cause substantial hardship, the DOI will, if possible, advance the time on processing the application.
3. After the applicant has completed the initial showing, the BLM will conduct an environmental analysis of the PRLA which will involve either an environmental assessment or an environmental impact statement.
4. Upon completion of the environmental analysis, which includes application of unsuitability criteria, the BLM will request a final showing by the applicant consistent with the regulations. Upon approval, a lease will be issued.

HISTORY AND BACKGROUND INFORMATION

Coal prospecting permits for all of the PRLAs were issued between 1967 and 1970. Between 1971 and 1973 the various permittees applied for Preference Right Leases.

The applicants have already done sufficient exploratory drilling on each of the PRLAs to confirm the existence of sufficient amounts of coal to qualify for initial showing. However, additional exploratory drilling would almost certainly be needed to obtain more detailed information about the coal deposits underlying the area. This information would include the thickness of overburden and interburden, continuity of coal beds, physical qualities of the coal including heating value, moisture, ash, volatile matter and fixed carbon content, and chemical qualities of the coal including sulfur and trace element content.

The leasing decision is non-discretionary. The Mineral Leasing Act of 1920 stipulates that ". . . the Secretary of the Interior may issue, to applicants qualified under this Act, prospecting permits. . ." and that if ". . . the permittee shows to the Secretary that the land contains coal in commercial quantities, the permittee shall be entitled to a lease under this Act for all or part of the land in his permit . . ."

AUTHORIZING ACTIONS

Leasing and development is under the authority of (1) the Mineral Leasing Act of February 25, 1920, as amended by the Federal Coal Leasing Amendments Act of 1976 and the Act of October 30, 1978; (2) the Multiple Minerals Development Act of August 13, 1954; (3) the Federal Land Management and Policy Act (FLPMA) of 1976; (4) the Surface Mining Control and Reclamation Act (SMCRA) of 1977; and (5) applicable Bureau of Land Management (BLM), U.S. Geological Survey (USGS), and Office of Surface Mining Reclamation and Enforcement (OSM) regulations.

Federal agency responsibilities for the management of federally owned coal are listed in part VIII of the July 19, 1979 Federal Register. The proposed leases would be issued to the applicant on a noncompetitive basis, only after the applicant has met all legal requirements. State and local agency requirements as well as Navajo Tribal requirements will be met as appropriate.

LEGAL AND REGULATORY REQUIREMENTS INCLUDED AS PART OF THE PROPOSED ACTION

If leases are issued, the company must comply with all federal, state, and local laws and regulations and with decisions governing development, operation, abandonment, and reclamation of the mine and transportation routes. In addition, based on interpretation of OSM requirements, the company is required to submit a mining and reclamation plan for the demonstration of feasible methods to accomplish: (1) successful reclamation within 10 years after mining has ceased, and (2) the reestablishment of vegetative cover, vegetative composition, and soil productivity to premining levels in the area of the refuse and waste stockpiles and transport routes. Before the issuance of BLM rights-of-way for transportation and utility incidental to mining activities on the PRLAs, the OSM must approve or indicate its pending approval of the federal mine plan related to mining activities on the leases. All rights-of-way appli-

The FCLAA requires that coal leasing and mining must be compatible with land-use planning within all public land areas. Under the FCLAA, coal leases cannot be issued unless compatible with such plans. The PRLA Area is included in the Chaco Planning Unit. The MFP for this Planning Unit is the responsibility of the BLM Farmington Resource Area Manager, with final approval by the Albuquerque District Manager and the New Mexico State Director. The MFP update for the Chaco Planning Unit will be completed in September 1981.

In this MFP, the BLM has identified coal resources in the Chaco Planning Unit. These coal resources are now being considered in the multiple-use planning analysis of the MFP to determine which coal lands are suitable to be considered further for leasing. After this planning analysis, which will include public comment and review, the final MFP decision will identify areas suitable for coal leasing subject to environmental assessment and the national coal leasing policy constraints and guidelines.

chapter 2

AFFECTED ENVIRONMENT

CHAPTER 2

AFFECTED ENVIRONMENT

This chapter contains a description of those components of the environment that are likely to be impacted by the mining of coal on the PRLAs. Descriptions correspond to the expected magnitude, intensity, and duration of impacts discussed in Chapter 3. Technical material and methodology that support these descriptions are located either in the appendix of this document or in the files of the Albuquerque District Office of the Bureau of Land Management (BLM).

AIR QUALITY

The PRLA Area is primarily rural. It is geographically located within the central air quality subarea as analyzed in the Star Lake-Bisti Regional Coal Final Environmental Statement (USDI, BLM 1979). Air quality data for sulfur dioxide, nitrogen dioxide and carbon monoxide have been collected in the area containing the Four Corners and San Juan Generating Stations and the greatest population density. These data as well as the data on concentrations of Total Suspended Particulates were included in the Star Lake-Bisti EIS.

In general, the air quality is well above the federal secondary and state air quality standards. Concentrations of regulated pollutants are low in comparison with these federal standards. Visibility in the area is good, with an annual average of at least 35 miles. The greatest visibility occurs during the summer and the least visibility during the winter.

TOPOGRAPHY AND GEOLOGY

Topography

The PRLA Area consists, over most of its extent, of a poorly dissected, moderately rolling plain underlain by flatlying sedimentary rocks (Map 2-1). The slope is generally west-southwestward. Locally moderate dissection of the plains has left isolated steep-sided mesas and buttes. Flat areas contain small hummocks and stabilized sand dunes in places.

The entire area drains generally southwestward into Chaco Wash, with the exception of the easternmost township. Elevations range from under 5,900 feet in the western part of the area to about 6,700 feet in the eastern part. The area extends almost 50 miles from east to west so that the approximately 800 feet of relief results in relatively gentle topography.

Stratigraphy

The PRLA Area is underlain almost entirely by the Kirtland and Fruitland Formations, both of Cretaceous age. A few small pieces of land at the southern margin of the area are underlain by the Cretaceous Pictured Cliffs Sandstone.

Total thickness of the Kirtland Formation ranges up to 1,500 feet. The Kirtland has been divided into two units. The upper unit consists of the upper shale member and the Farmington Sandstone member, and the lower unit consists of the lower shale member. Little coal or carbonaceous shale is present in the Kirtland Formation.

The Fruitland Formation consists of interbedded sandstone, siltstone, shale, carbonaceous shale, carbonaceous sandstone, carbonaceous siltstone, coal, and limestone. The coal beds contain one to three economically valuable coal seams in the PRLA Area. These beds are found in the lower 150 feet of the Fruitland Formation and are highly lenticular. Available data pertaining to number of beds, thickness and estimated reserves are presented in Table 2-1.

Most of the coal is ranked as subbituminous A with some ranked as borderline high-volatile bituminous C (refer to the Glossary for a discussion of rank). The BTUs per pound average between 8,500 and 10,200, resulting in the heating value of the coal being slightly below average. Sulfur content averages about 0.6 percent, making this a relatively low sulfur coal.

The location of the coal ranges in depth from just below the surface to over 500 feet. The companies applying for leases will probably strip mine seams less than 250 feet in depth, recovering deeper coal by underground methods. Map 2-1 indicates the portions of the PRLA Area containing coal recoverable by stripping or underground mining methods.

Structure

The PRLA Area is located in the south-central portion of the San Juan Basin. Structurally, the San Juan Basin constitutes the southeastern portion of the Colorado Plateau. The formations underlying the area are nearly horizontal, dipping 1 to 3 degrees northeastward toward the center of the Basin. The strike (refer to Glossary) is northwest-southeast.

No faults are known to occur in the area. Any faults that may be discovered by mining operations would probably be discontinuous and have displacements of no more than several feet.

Non-Coal Mineral Resources

Other than coal, oil and gas are the mineral resources most frequently found within the PRLA Area. A number of oil-and-gas producing formations underlie the PRLA Area but at a much greater depth than the coal beds. The most significant of these oil and gas producers are the Pictured Cliffs, Cliff House and Point Lookout Sandstones, Mancos Shale, and Dakota Sandstone (all of Late Cretaceous age), the Hermosa and Paradox Formations (of Pennsylvanian Age), and the Ouray Limestone (of Devonian Age).

The entire PRLA Area has been classified as prospectively valuable for oil and gas by the U.S. Geological Survey (USGS). Only two small, undefined Known Geologic Structures (KGSs) are located in the PRLA Area (Map 2-2). (A KGS is a subsurface geologic structure identified by the USGS as having significant potential for oil and gas production.) However, other potentially valuable subsurface structural or stratigraphic traps in the area may yet be discovered. Any traps that may exist would probably not show surface expression to aid in the exploration for them.

On or near the PRLA Area, a number of abandoned and active oil and gas wells also exist (Table 2-2). One of the abandoned wells on NM-11670 was a gas producer, and one on NM-8128 was an oil producer. Two active oil wells are located about one-half mile south of NM-8128, and six about one-half mile southeast of NM-585.

R. 13 W.

R.

R. 6 W.

R. 5 W.

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
ALBUQUERQUE DISTRICT OFFICE
ALBUQUERQUE, NEW MEXICO

COAL PREFERENCE RIGHT LEASING-NEW MEXICO

MAP 2 - 1
TOPOGRAPHY

T.
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LEGEND

- Preference Right Lease Application
- 250' Overburden Depth
- Coal Outcrop Line



NORTH

1 0 1 2 3 4 5

MILES

Contour Interval - 20 Meters

R. 13 W.

R. 1

R. 6 W.

R. 5 W.

The Fruitland Formation consists of interbedded sandstone, siltstone, shale, carbonaceous shale, carbonaceous sandstone, carbonaceous siltstone, coal, and limestone. The coal beds contain one to three economically valuable coal seams in the PRLA Area. These beds are found in the lower 150 feet of the Fruitland Formation and are highly lenticular. Available data pertaining to number of beds, thickness and estimated reserves are presented in Table 2-1.

Most of the coal is ranked as subbituminous A with some ranked as borderline high-volatile bituminous C (refer to the Glossary for a discussion of rank). The BTUs per pound average between 8,500 and 10,200, resulting in the heating value of the coal being slightly below average. Sulfur content averages about 0.6 percent, making this a relatively low sulfur coal.

The location of the coal ranges in depth from just below the surface to over 500 feet. The companies applying for leases will probably strip mine seams less than 250 feet in depth, recovering deeper coal by underground methods. Map 2-1 indicates the portions of the PRLA Area containing coal recoverable by stripping or underground mining methods.

Structure

The PRLA Area is located in the south-central portion of the San Juan Basin. Structurally, the San Juan Basin constitutes the southeastern portion of the Colorado Plateau. The formations underlying the area are nearly horizontal, dipping 1 to 3 degrees northeastward toward the center of the Basin. The strike (refer to Glossary) is northwest-southeast.

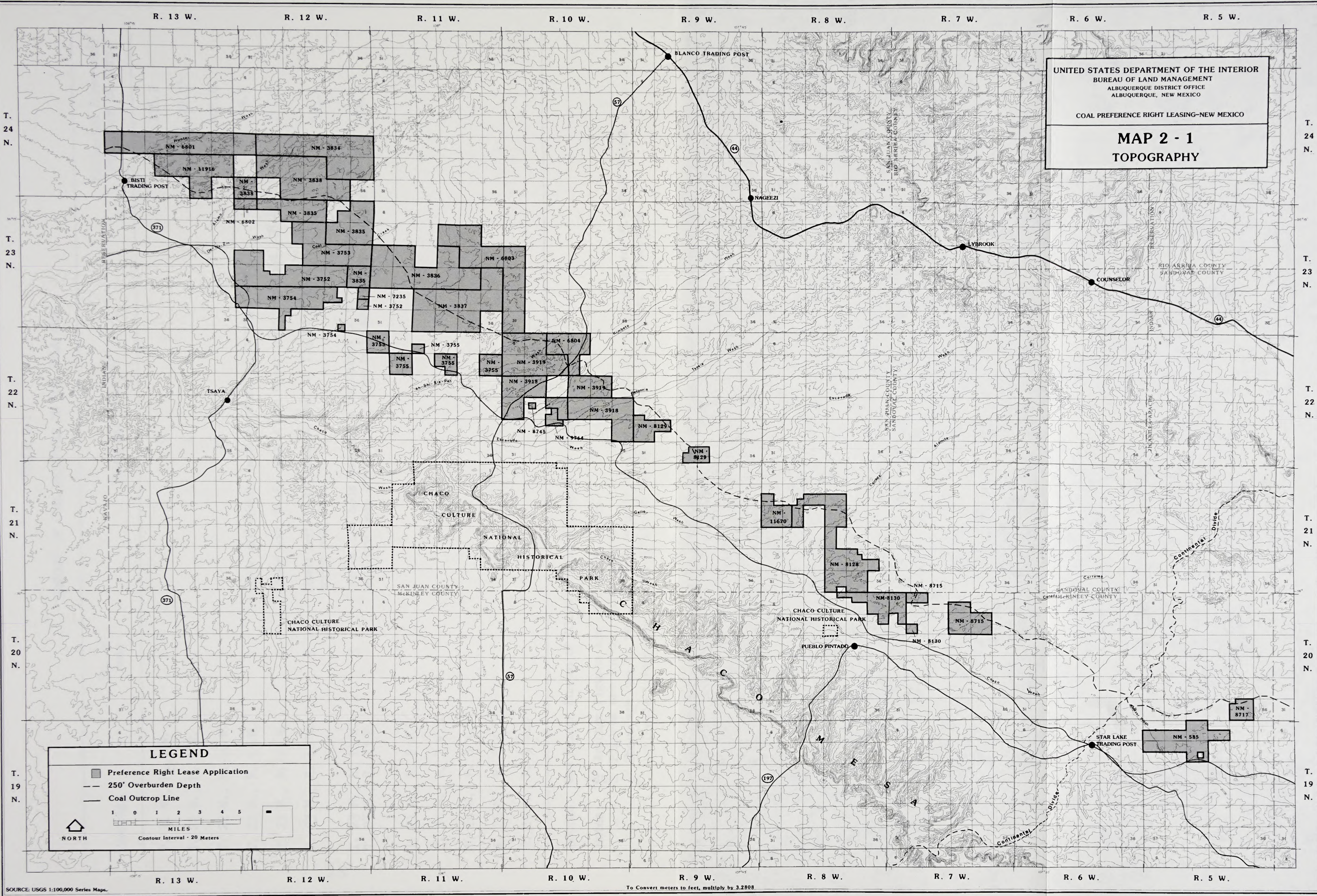
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UNITED STATES DEPARTMENT OF THE INTERIOR
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ALBUQUERQUE DISTRICT OFFICE
ALBUQUERQUE, NEW MEXICO

COAL PREFERENCE RIGHT LEASING-NEW MEXICO

MAP 2 - 1
TOPOGRAPHY

LEGEND

- Preference Right Lease Application
- 250' Overburden Depth
- Coal Outcrop Line

1 0 1 2 3 4 5
MILES
Contour Interval - 20 Meters

NORTH

TABLE 2-1

SUMMARY OF COAL RESERVES IN THE PRLA AREA

Township	No. of Beds	Thickness (Feet) <u>a/</u>	Estimated Reserves ^{b/} (Millions of Tons)
T. 21 N., R. 9 W.	1	6	118.2
T. 22 N., R. 9 W.	1	4	22.0 ⁺
T. 22 N., R. 10 W.	1	25	401.0
T. 22 N., R. 11 W.	3	Lower and middle beds combined, 13; upper bed, 8	159.9
T. 23 N., R. 11 W.	3	Lower bed, 9-15; middle and upper beds combined, 28-47	347.0
T. 23 N., R. 12 W.	3	Lower bed, 9-32; middle bed, no figure given; upper bed, 0-21	545.6
T. 23 N., R. 13 W.	3	One of the beds reaches a thickness of 6; the other two beds are less than 6; all three beds are highly lenticular	276.0
T. 21 N., R. 8 W. <u>c/</u>			
T. 20 N., R. 7 W. <u>c/</u>			
T. 20 N., R. 8 W. <u>c/</u>			
T. 20 N., R. 5 W. <u>c/</u>			
T. 19 N., R. 5 W. <u>c/</u>			

Source: New Mexico Bureau of Mines & Mineral Resources 1971.

Notes: a/ Average figures are used where given.b/ Figures are for all beds combined.c/ There are one to two coal beds underlying these townships, ranging up to 15.9 feet thick.
Available information is insufficient for an accurate calculation of reserves.

TABLE 2-2
NUMBER OF ABANDONED OIL AND GAS WELLS ON THE PRLAs

PRLA No.	Number of Wells	PRLA No.	Number of Wells
NM-585	1	NM-6801	2
NM-3752	1	NM-6803	3
NM-3754	3	NM-8128	5
NM-3834	1	NM-8130	1
NM-3836	1	NM-9764	1
NM-3837	1	NM-11670	2
NM-3919	1		

Source: USDI, BLM 1980a.

Appendix B contains a listing of lands in the PRLA Area that are currently under lease for oil and gas. None of these leases are currently in production, and it is not known if and when exploratory activities may occur in the future.

A very small amount of low-grade uranium ore has been found at scattered localities in the Fruitland Formation. The Jurassic Morrison Formation, which lies about 3,000 to 5,000 feet beneath the surface, contains valuable deposits of uranium in places. Uranium has been deep-mined profitably at other localities. The numerous mining claims covering the PRLA Area are most likely for uranium, although it is not known exactly what minerals these claims have been staked for because the claimant is not required to give this information.

VEGETATION

BLM personnel have mapped and described vegetation sites throughout most of the PRLA Area based on dominant vegetation, Soil Conservation Service range sites, and soils information. At the extreme western portion of the area (the portion that overlaps the Navajo Indian Irrigation Project), sites were delineated from aerial photographs.

Eleven vegetation sites occur within the boundaries of the PRLAs. The amount of each that occurs within each PRLA is shown in Table 2-3. Descriptions of these sites are found in Appendix C.

R. 13 W.

R.

R. 6 W.

R. 5 W.

T.
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T.
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N.

T.
19
N.

UNITED STATES DEPARTMENT OF THE INTERIOR
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ALBUQUERQUE DISTRICT OFFICE
ALBUQUERQUE, NEW MEXICO

COAL PREFERENCE RIGHT LEASING-NEW MEXICO

MAP 2 - 2

KNOWN GEOLOGIC STRUCTURES (KGS)

BISTI
TRADING POST

NM - 6801

NM - 11916

NM - 3838

NM - 6802

NM - 3754

TSAYA

COUNSELOR

RIO ARriba COUNTY
SANDOVAL COUNTY

CHAC
NATIO

SANDOVAL COUNTY
McKINNEY COUNTY

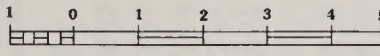
STAR LAKE
TRADING POST

NM - 8717

NM - 585

LEGEND

- Preference Right Lease Application
- Defined KGS
- Undefined KGS



Contour Interval - 20 Meters
SOURCE: USDI, BLM 1980.

R. 13 W.

R. 1

R. 6 W.

R. 5 W.

TABLE 2-2
NUMBER OF ABANDONED OIL AND GAS WELLS ON THE PRLAs

PRLA No.	Number of Wells	PRLA No.	Number of Wells
NM-585	1	NM-6801	2
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NM-3754	3	NM-8128	5
NM-3834	1	NM-8130	1
NM-3836	1	NM-9764	1
NM-3837	1	NM-11670	2
NM-3919	1		

Source: USDI, BLM 1980a.

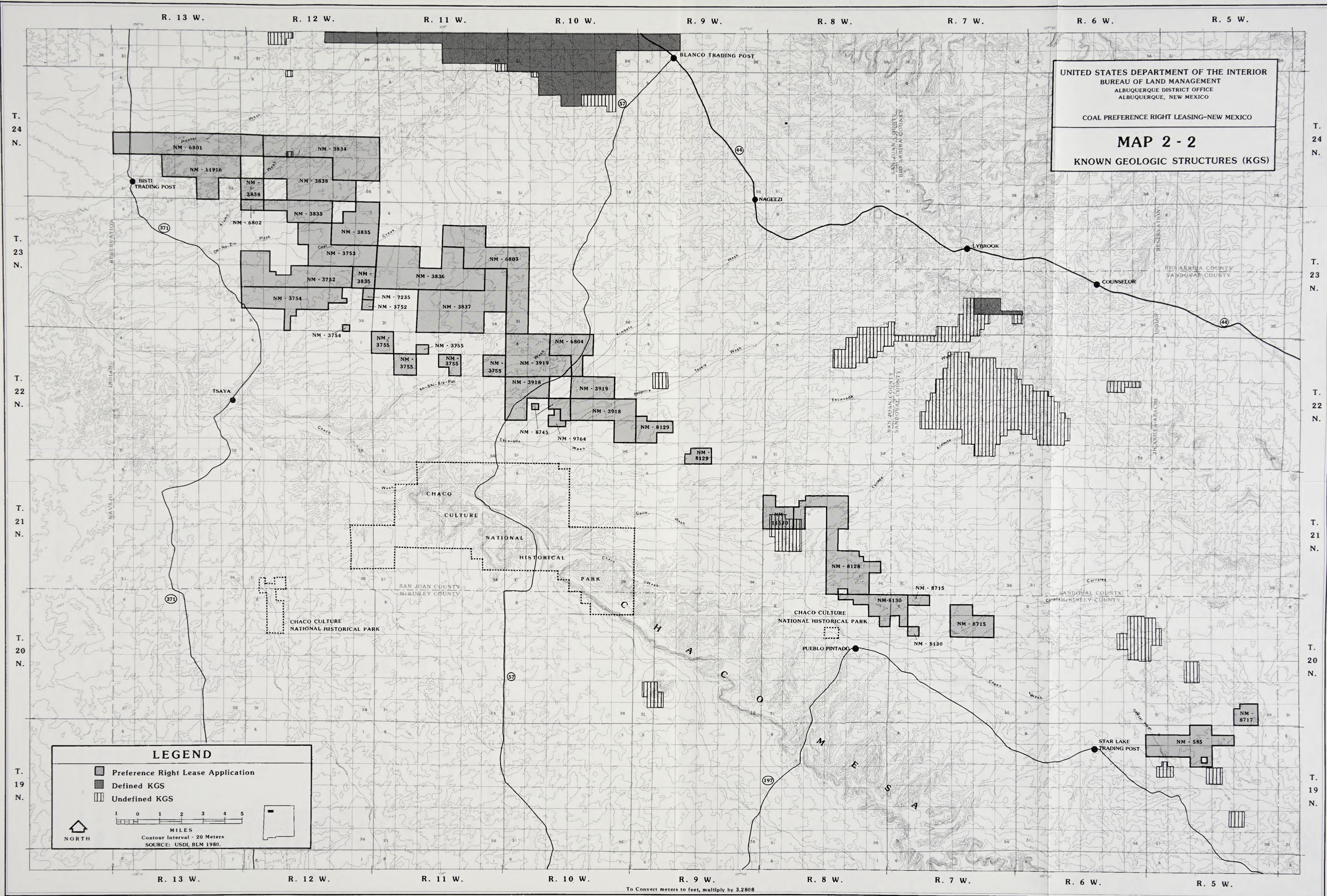
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UNITED STATES DEPARTMENT OF THE INTERIOR
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ALBUQUERQUE DISTRICT OFFICE
ALBUQUERQUE, NEW MEXICO

COAL PREFERENCE RIGHT LEASING-NEW MEXICO

MAP 2 - 2
KNOWN GEOLOGIC STRUCTURES (KGS)

LEGEND

- Preference Right Lease Application
- Defined KGS
- Undefined KGS

1 0 1 2 3 4 5
MILES
Contour Interval - 20 Meters
SOURCE: USDI, BLM 1980.

NORTH

To Convert meters to feet, multiply by 3.2808

TABLE 2-3

ACRES OF VEGETATION SITES OCCURRING ON THE PRLAs

PRLA No.	L-S a/	LB-S	S-S	DS-GS	SS-G	S-PJ	SS-PJ	SF-H	Ba	Du	Rw	Totals
NM-585	103	653	655	1,767	452	7		265	676			2,811
NM-3752				690	609				1,384			3,760
NM-3753	132	714		500	531				1,016			2,951
NM-3754	211			1,525	1,872				571			3,075
NM-3755	242			423	3				849			2,588
NM-3834				1,938	69				4,139			4,804
NM-3835	397	1,918		1,330					575			4,500
NM-3836	517	2,507		3,265					876			5,110
NM-3837	389	1,193		569					145			5,120
NM-3838	1,777	248		712	932		149		3,829	14	249	4,787
NM-3918	691	18		428	105				396	133	81	4,477
NM-3919				1,603					3,022			4,478
NM-6801	87	1,916		652	100				2,791			4,394
NM-6802	1,273	188							253			340
NM-6803	264								1,280		17	5,121
NM-6804									1,033			1,602
NM-7235	847	1,367		160			227	9	348			160
NM-8128	117	123		851					366		63	4,499
NM-8129	375	109	110	1,173				366				1,520
NM-8130	604	164	594	52				444	63			2,133
NM-8715	135	1	365					58	41			1,921
NM-8717	136	95			88					96	105	600
NM-8745	103	115		639	110					5	17	520
NM-9764	370			35					2,845			240
NM-11670												1,119
NM-11916												2,880
TOTALS	8,770	11,329	1,724	20,013	4,871	7	376	1,142	26,498	248	532	75,510

Source: USDI, BLM 1980a.

Note: a/ Designations of sites are: L-S = Loamy-Sagebrush; LB-S = Loamy Bottom-Sagebrush; S-S = Sandy-Sagebrush; DS-GS = Deep Sand-Grassland-Saltbush; SS-G = Sodic Slopes-Grassland; S-PJ = Shallow-Pinyon-Juniper; SS-PJ = Sandy to Shallow-Pinyon-Juniper; SF-H = Salt Flats-Halophytic; Ba = Badlands; Du = Dunelands; Rw = Riverwash-Wetlands.

Threatened, Endangered, And Special Interest Plants

There are no known populations of federally listed threatened or endangered plant species in the PRLA Area. This area was surveyed by Spellenberg (1976) who found none of the species proposed for listing as threatened or endangered (Federal Register, Vol. 40, No. 117, July 1, 1975; and Vol. 41, No. 127, June 16, 1976). A 1980 printout from the New Mexico State Heritage Program shows no location of these species in the PRLA Area.

Neither does this printout list special interest plants as occurring on the proposed lease area. However, it does show that Androstephium breviflorum and Astragalus kentrophyta var. neomexicanus occur nearby in the Chaco Culture National Historical Park. These plant species are of special interest because of their restricted ranges.

CLIMATE

The climate of the PRLA Area is semi-arid with relatively warm summers and cold winters. The average annual precipitation varies from about eight inches at the western portion of the area to about ten inches at the Continental Divide, near the eastern portion of the area. The total annual precipitation varies by year from less than one-half to nearly twice this average annual amount. In most years there is considerable variation in the amount of precipitation received in different seasons. In an average year, nearly one-half of the precipitation occurs during July, August, and September. The precipitation generally includes snow in the winter, rain in the summer, and both of these in the spring and fall. Winter precipitation generally occurs from air masses that originate over the Pacific Ocean or Canada. Summer precipitation usually occurs as localized thunderstorms in air masses that originate off the west coast of Mexico.

The potential evapotranspiration for this area is greater than the precipitation. Tuan et al. (1973) in their report on the climate of New Mexico state that there is an annual moisture deficit of from about 10 to about 14 inches in the PRLA Area. About 80 percent of this deficit occurs during the frost-free season.

Temperatures vary considerably with season and time of day. July is the warmest month, with maximum temperatures commonly above 90 degrees Fahrenheit. January is the coldest month, with daily minimum temperatures below freezing. The growing season (frost-free period) averages about 135 days per year. The last spring frost occurs about mid-May and the earliest fall freeze usually occurs around October 1st.

Precipitation and temperature data from weather stations near the PRLA Area are summarized in Appendix D.

SOILS

Eleven soil associations have been delineated in the PRLA Area (refer to Map 2-3). In general, low organic matter content, inadequate precipitation, and a moderate to high susceptibility to erosion are factors that limit successful reclamation of these soils. Other limitations include shallow depths, steep slopes, and high concentrations of soluble salts or exchangeable

R. 13 W.

R.

R. 6 W.

R. 5 W.

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
ALBUQUERQUE DISTRICT OFFICE
ALBUQUERQUE, NEW MEXICO

COAL PREFERENCE RIGHT LEASING-NEW MEXICO

MAP 2 - 3 SOIL ASSOCIATIONS

T.
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INDIAN RESERVATION
NAVAJO

INDIAN RESERVATION
JICARILLA-APACHE

RIO ARriba COUNTY
SANDOVAL COUNTY

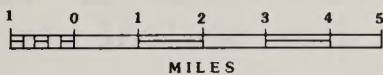
SANDOVAL COUNTY
McKINLEY COUNTY

CHA
NAT

LEGEND

Preference Right Lease Application

- | | |
|---------------------|---------------------|
| 1 Chipeta-Sheppard | 7 Persayo-Billings |
| 2 Badland-Rockland | 8 Shiprock-Sheppard |
| 3 Billings-Badland | 9 Penistaja-Pine |
| 4 Doak-Shiprock | 10 Persayo-Lohn |
| 5 Camborthids-Farb | 11 Hagerman-Tr |
| 6 Rockland-Billings | |



SOURCE: NMSU, USDA, SCS 1973, 1974.

R. 13 W.

R.

R. 6 W.

R. 5 W.

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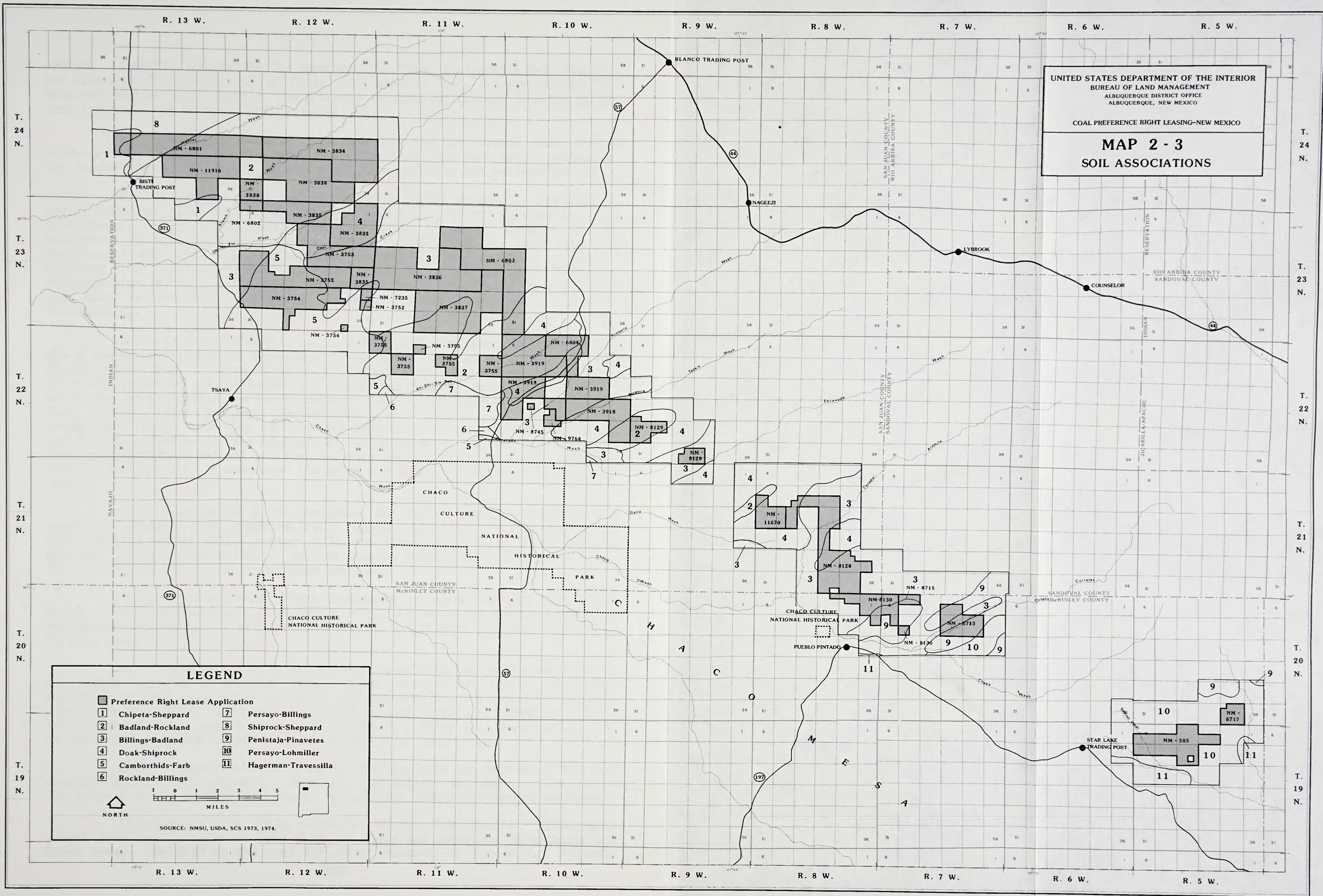
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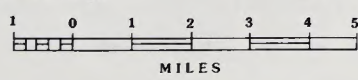
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
ALBUQUERQUE DISTRICT OFFICE
ALBUQUERQUE, NEW MEXICO

COAL PREFERENCE RIGHT LEASING-NEW MEXICO

MAP 2 - 3
SOIL ASSOCIATIONS

LEGEND

- | | |
|--------------------------------------|-------------------------|
| ■ Preference Right Lease Application | |
| 1 Chipeta-Sheppard | 7 Persayo-Billings |
| 2 Badland-Rockland | 8 Shiprock-Sheppard |
| 3 Billings-Badland | 9 Penistaja-Pinavetes |
| 4 Doak-Shiprock | 10 Persayo-Lohmiller |
| 5 Camborthids-Farb | 11 Hagerman-Travessilla |
| 6 Rockland-Billings | |



SOURCE: NMSU, USDA, SCS 1973, 1974.

sodium. (Specific information for each soil is found in Appendix E-1, Physical and Chemical Characteristics of Soils and Appendix E-2, Interpretations for Selected Uses of Major Soils.) The presence of limiting factors is noted in the description of the affected soil associations.

Overburden material that may be used as topsoil must have a site-specific analysis to determine its suitability for such use. Generally, the sandier overburden parent materials are more suitable for reclamation use.

For reclamation, the application of a mulch is usually required to help stabilize the soil and protect seedlings during germination and development. This stabilization and protection is needed because of the occurrence of wind and water erosion (from gusting winds and high intensity rainstorms) and high soil surface temperatures during the growing season. Mulching (or other stabilization) also prevents excessive soil loss and sedimentation of soils with a high susceptibility to erosion. Fertilization may also be necessary, depending on soils analysis for plant nutrient availability.

Soils in Associations 1, 3, 7, and 10 are developing in sandstone or shale parent materials or alluvium, or in deep, wind-deposited sands. The shallow (less than 20 inches deep) to moderately deep soils (20-40 inches deep) generally occur on the hillsides and valley sideslopes; deep, finer textured soils are on floodplains or broad alluvial fans. The coarser textured soils have limited water holding capacity and are difficult to stabilize and revegetate. Soils with clay textures are also difficult to reclaim because of their high shrink-swell characteristics, restriction to root development, and slow permeability. Badland and rock outcrop inclusions are generally unsuited for reclamation use. A number of the soils are adversely affected by salts and alkali.

Soil Association 6 is dominated by rough, broken topography and rockland, primarily of sandstone/shale parent material. Soils are highly variable; the narrow valley bottom soils are clayey and slowly permeable, and may have a high sodium content. Gullies dissect these areas. This association is not suitable for use as reclamation material.

Soils in Association 5 are developing on sandstone and interbedded shale. They are shallow to moderately deep, and occur on gently sloping to undulating topography. Depth over bedrock is the primary limiting factor for various uses.

Soil Associations 4, 8, and 9 occur in alluvial and eolian deposits on old stream terraces or alluvial fans. These deposits are fairly thick over sandstone or shale, and soils are deep. Associations 8 and 9 contain loamy fine sand or sand-textured soils with low water-holding capacities; they are highly susceptible to wind and water erosion. Overall, these soil associations are suitable for reclamation use on slopes of less than 15 percent.

Soils in Association 11 occur on the mesa tops and benches. They are usually shallow to moderately deep over sandstone or shale. The major limitations to use include soil depth, erodability, and inclusions of rockland.

Association 2 is quite extensive in San Juan County. Topography ranges from nearly level to very steep on shale and sandstone escarpments and break areas. Badland is the most extensive component of the unit. Sediment

yield is high. Slow permeability, salts, and alkali are factors that severely limit the suitability of this association for reclamation or other uses. Paleontological deposits further restrict the uses of this unit.

WATER RESOURCES

Surface Water

Surface water is scarce in the PRLA Area. Average annual rainfall (8 to 10 inches) is insufficient to produce any perennial streams; all drainages are ephemeral. PRLAs NM-585 and NM-8717 are east of the Continental Divide and drain to Torreon Wash via Salazar and Papers Washes. All other PRLAs are west of the Continental Divide and drain to Chaco Wash. Major tributaries draining the PRLA Area to Chaco Wash are Canada Corrales, Canada Alamita, Gallo Wash, Escavada Wash, Betonnie Tsosie Wash, Kimbeto Wash, Ah-shi-sle-pah Wash, Coal Creek, De-na-zin Wash, Alamo Wash, and Hunter Wash.

Streamflow data for Papers, Chaco, Gallo, Ah-shi-sle-pah, De-na-zin, and Hunter Washes are collected and reported by the U.S. Geological Survey (USGS) in the annual publication, Water Resources Data for New Mexico. Summaries of this data are on file in the BLM Albuquerque District Office. Flow-duration curves for these washes are presented in Appendices F-1 through F-II-7. Streamflow characteristics for De-na-zin and Hunter Washes are discussed in detail in the Bisti West Study Site EMRIA Report (USDI, BLM, BR & GS 1976), and streamflow characteristics for Ah-shi-sle-pah, Kimbeto, and Betonnie Tsosie Washes are discussed in detail in the Kimbeto EMRIA Report (USDI, BLM, WPRS & GS 1981). Runoff characteristics for a much smaller watershed (Tsosie Swale) are discussed in detail in Shown, et al., (1981).

In general, about half of the annual precipitation occurs in the form of intense, local, summer thunderstorms that produce ephemeral streamflows lasting up to 24 hours. Snowmelt from occasional winter storms may produce streamflow lasting up to two weeks or more in the early spring. Because of the sporadic nature of precipitation events, surface water is an unreliable source of supply.

Estimates of runoff entering and leaving the PRLAs will be developed with each mine plan and included in the application for a permit to mine. These estimates will be based on recorded precipitation data and basin characteristics, as USGS streamflow records are too short for statistical estimates of annual runoff or peak flows. The USGS is currently evaluating drainage area, channel geometry, and hydrologic soil groups as relevant factors for estimating runoff (Bob Hejl, USGS, pers. comm. 1981). The Star Lake Mining Plan (Chaco Energy Co. 1980) estimates peak flows for various return periods for Salazar, Papers, and North Fork Chaco Washes where they enter and leave the proposed mine area. These estimates were developed using the unit hydrograph procedure developed by the Soil Conservation Service (USDA, SCS 1971).

Ground Water

The PRLA Area is centrally located in the San Juan Underground Water Basin. This basin was declared in 1976, making it necessary to obtain a permit from the State Engineer to appropriate ground water in the Basin. The San Juan Underground Water Basin is part of the larger San Juan structural basin, which

is bound by the San Juan and La Plata Mountains to the north, the Defiance Uplift and the Arizona state line on the west, the Zuni Mountains and Interstate 40 on the south, and the Nacimiento Uplift and Rio Grande Rift on the east. Recharge to most aquifers occurs at topographically higher areas on the edges of the structural basin, and water flows downdip toward the center of this basin, where it is encountered under artesian pressure. The stratigraphy of the basin is described in the Star Lake-Bisti Regional Coal Final Environmental Statement (USDI, BLM 1979). Detailed information on the depth, thickness, and elevation of the major aquifers is presented in Stone and Mizell (1978), and detailed information on the direction of ground water flow in each of the major aquifers in Lyford and Frenzel (1978) and Lyford (1979).

In general, most sandstones in the basin yield some water to wells. The sandstones are usually confined under impermeable, younger strata, so water is frequently under artesian pressure. Most of the sandstones are fine-grained and silty and yield only enough water for stock and domestic use. Some of the deeper sandstones are coarser and produce higher yields (the Gallup Sandstone, the Westwater Canyon Member of the Morrison Formation, and the Entrada Sandstone). These formations are probably the most reliable sources of water in the basin.

Table 2-4 summarizes available information on the aquifer characteristics in the Bisti area. Most of the wells in the PRLA Area draw water from one or more of these aquifers. Additional information on well depths, yields, and water-producing zones is presented in the following discussion of water uses in the area.

Water Uses

The erratic nature of the precipitation in the PRLA Area makes surface water an unreliable source of supply. Nevertheless, many small stock ponds have been constructed to trap ephemeral surface runoff in small channels. As long as these ponds impound less than 10 acre-feet, a permit from the State Engineer for appropriating surface water is not required.

Four playa lakes have been identified in the vicinity of the PRLAs (Table 2-5). These lakes exist as natural playas during periods of heavy runoff, but all have been enhanced by man-made structures. Tanner Lake near Bisti had some early developments for irrigation, but the dam is breached, and the lake retains very little runoff. An application to appropriate surface water, previously submitted to the State Engineer for Tanner Lake, has since been withdrawn (Brad Compton, NMSEO, pers. comm. 1981). The other three lakes are also ephemeral, catching occasional surface runoff. These lakes furnish livestock water and wildlife habitat when water is present. Applications for permits to appropriate surface waters have not been received by the State Engineer for any of these lakes (Brad Compton, NMSEO, pers. comm. 1981) Thus, it is unlikely that the lakes provide a reliable source of water for any other uses.

TABLE 2-4

GROUND WATER BEARING UNITS NEAR BISTI

Geologic Unit	Depth (ft)	Direction of Flow	Rate of Flow	Yield ^{a/}	Chemical Quality ^{b/}	Potential for Supply
Kirtland-Fruitland Formation	Surface-250 ft	West	<10 ft/yr (estimated)	<10 gpm (estimated)	poor; spec. cond. >3,000 umhos; exceeds 10,000 umhos in places	very poor
Pictured Cliffs Sandstone	Surface-500 ft	Northwest	<10 ft/yr (estimated)	<10 gpm (estimated)	very poor; spec. cond. >10,000 umhos; high, Na, SO ₄	very poor
Cliff House Sandstone	Surface-1,000 ft	Northwest	<10 ft/yr (estimated)	<10 gpm (estimated)	poor; spec. cond. >2,000 umhos	poor
Menefee Formation	500-1,500 ft	Northwest	<10 ft/yr (estimated)	<10 gpm (estimated)	poor; spec. cond. >5,000 umhos	poor
Point Lookout Sandstone	2,300-3,300 ft	No data but probably Northwest	No data but probably <10 ft/yr	No data but probably <10 gpm	No data but spec. cond. probably >2,000 umhos	poor
Gallup Sandstone	3,000-4,000 ft	Northwest	<20 ft/yr (estimated)	<50 gpm (estimated)	fair in other areas; poor in study area; spec. cond. >4,000 umhos	poor to fair
Morrison Formation	4,500-5,500 ft	Northwest	<20 ft/yr (estimated)	<50 gpm but may be as high as 500 gpm	good to poor; spec. cond. range 1,000->6,000 umhos	fair to good
Entrada Sandstone	5,000-6,000 ft	Unknown	<20 ft/yr (estimated)	<50 gpm (estimated)	poor; spec. cond. >5,000 umhos; exceeds 20,000 umhos in places	poor

Source: USDI, BLM BR & GS 1976.

Notes: ^{a/} Yield expressed in gallons per minute (gpm).^{b/} Chemical quality expressed in micromhos (umhos); spec. cond. = specific conductance.

TABLE 2-5
PLAYA LAKES IN THE PRLA AREA

Lake	Location	Adjacent Lease No.
Tanner Lake (Bisti)	T. 23 N., R. 12 W., Secs. 17, 18	NM-3752
Black Lake	T. 22 N., R. 12 W., Sec. 1	NM-3754 NM-3755
Tanner Lake (east)	T. 20 N., R. 7 W., Sec. 15	NM-8715
Papers Lake	T. 19 N., R. 5 W., Secs. 17, 18	NM-585

Because surface water is an unreliable supply source, numerous wells have been drilled in the PRLA Area to develop the ground water resource. Map 2-4 depicts the location of all known wells in the vicinity of the PRLAs. It is likely that there are additional wells in the area that are unknown to the BLM at this time. The wells depicted on this map were identified from BLM files and from a report prepared for the New Mexico Energy and Minerals Department by Geohydrology Associates, Inc. (1980).

Information on the well depth, depth-to-water, water-bearing unit, water-producing interval, well yield, and drawdown (if tested) for most of the wells on Map 2-4 is on file in the BLM Albuquerque District Office. In addition, Appendix F-8 contains excerpts from the Geohydrology Associates (1980) report describing the aquifers that are presently producing water in the Bisti and Star Lake areas. The appendix does not discuss the Entrada Sandstone or the Westwater Canyon Member of the Morrison Formation, as these are not currently developed for water production in this area. These aquifers are mentioned here because they are good, deep aquifers, capable of producing large well yields, and likely to be developed for reclamation of mined areas.

Presently, ground water in the PRLA Area is used mostly for livestock watering and domestic purposes. The quality of water for these uses is discussed in the water quality section below. Some of the wells appearing on Map 2-4 are abandoned livestock wells. Others are wells drilled in conjunction with coal, oil, gas, and uranium exploration. Many of the wells identified on this map are observation wells, developed for monitoring coal mining impacts to ground water in the area.

The San Juan Basin was declared an Underground Water Basin on July 29, 1976. Any wells constructed prior to that date do not need a permit to

appropriate the underground waters of the basin if diligence in developing and using the water can be demonstrated. Most stockwater and domestic wells in the area fall into this category. Exploration, livestock, and domestic wells drilled after July 29, 1976, require a permit to appropriate the ground waters of the basin in accordance with Section 72-12-1 of the New Mexico Statutes. Under this law, the State Engineer may issue a permit without a public notice for wells using less than three acre-feet per year. All wells drilled after July 29, 1976, and producing greater than three acre-feet per year require a regular permit from the State Engineer to appropriate ground water in the basin. This includes wells drilled for development of coal resources. These permits are issued only after public notice and are subject to protest by affected parties with existing water rights.

Water Quality

Surface water quality is poor in the PRLA Area. Water quality has been sampled at streamflow gages on Papers, Chaco, Callo, Ah-shi-sle-pah, De-na-zin, and Hunter Washes, as well as at several miscellaneous sites throughout the area. Statistical summaries of surface water quality data collected by the USGS in the strippable coal area are on file in the BLM Albuquerque District Office. Additional information on surface water quality in the PRLA Area is discussed in the Bisti West (USDI, BLM, BR & GS 1976) and Kimbeto EMRIA Reports (USDI, BLM, WPRS & GS 1981).

The dissolved solids content of the surface water in the PRLA Area generally ranges from 500 to 1,500 milligrams per liter (mg/l), with the predominant ions being sodium, bicarbonate, and sulfate. The predominance of sodium over calcium and magnesium means the water has low hardness, and the predominance of bicarbonate gives the water a high capacity for neutralizing acid. The pH range of the surface waters of this area (7.5 to 8.5) is in the upper range of most natural waters. Dissolved concentrations of most trace elements are low in the PRLA Area; however, total concentrations are high due to adsorption of trace elements on the surfaces of fine sediments carried in suspension.

Appendices F-9 through F-11 list recommended water quality criteria for livestock and wildlife watering, irrigation, and human consumption. Concentrations of dissolved solids in surface water in the area are usually within the recommended levels for livestock watering and irrigation. However, the use of surface water for reclamation is not likely for the following reasons. First, as the flow-duration curves in Appendices F-1 through F-7 indicate, surface water is an unreliable source of supply. Second, the major water quality problem with surface water in the PRLA Area is extremely high concentrations of suspended sediment. All surface flows seem to be accompanied by a suspension of very fine clay, which does not readily settle (USDI, BLM 1979). Retention dams built to capture ephemeral surface runoff could settle out some of the heavier sediments; however, evaporation and dissolution of salts adsorbed to fine sediments would produce much higher concentrations of dissolved solids. Concentrations of dissolved trace elements would also increase, although the high pH of the water would slow this process.

The high suspended sediment concentrations in the surface waters of the PRLA Area are a result of the high erodibility of many soils in the area. Map 2-5 shows source-area sediment yields for the PRLA Area, and are based on

R. 13 W.

R.

R. 6 W.

R. 5 W.

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BUREAU OF LAND MANAGEMENT
ALBUQUERQUE DISTRICT OFFICE
ALBUQUERQUE, NEW MEXICO

COAL PREFERENCE RIGHT LEASING-NEW MEXICO

MAP 2 - 4 HYDROLOGIC FEATURES

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N.T.
19
N.

LEGEND

Preference Right
Lease Application

Well

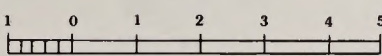
Spring



Qal - Water-bearing unit

6429 - Altitude of water table

6760 - Specific conductance



MILES

Contour Interval - 20 Meters

SOURCE: GEOHYDROLOGY ASSOCIATES, INC 1980.

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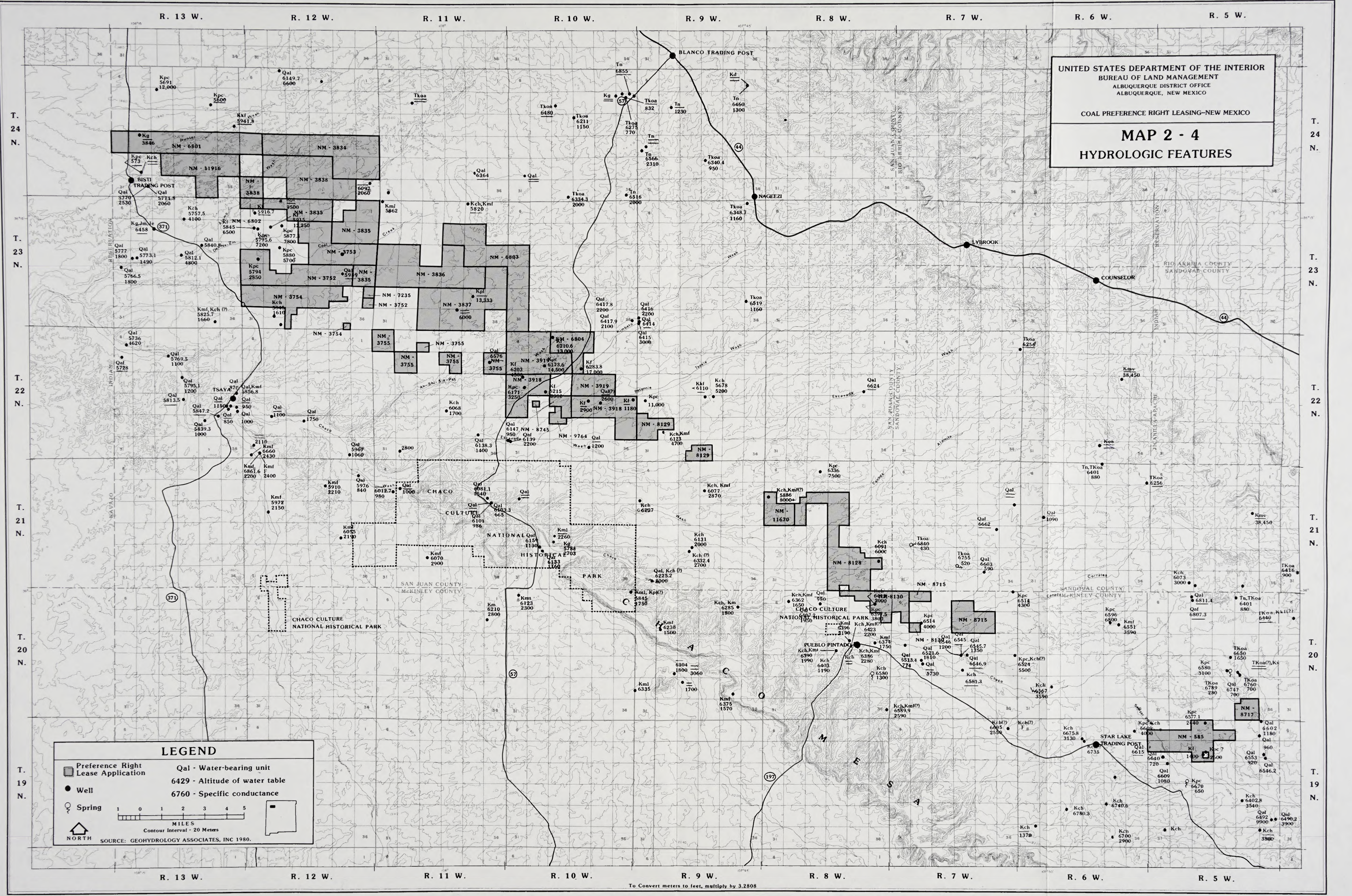
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COAL PREFERENCE RIGHT LEASING-NEW MEXICO

MAP 2 - 4
HYDROLOGIC FEATURES

LEGEND

Preference Right Lease Application

Qal - Water-bearing unit

6429 - Altitude of water table

6760 - Specific conductance

Well

Spring

1 0 1 2 3 4 5
MILES

Contour Interval - 20 Meters

SOURCE: GEOHYDROLOGY ASSOCIATES, INC. 1980.

To Convert meters to feet, multiply by 3.2808

R. 13 W.

R.

R. 6 W.

R. 5 W.

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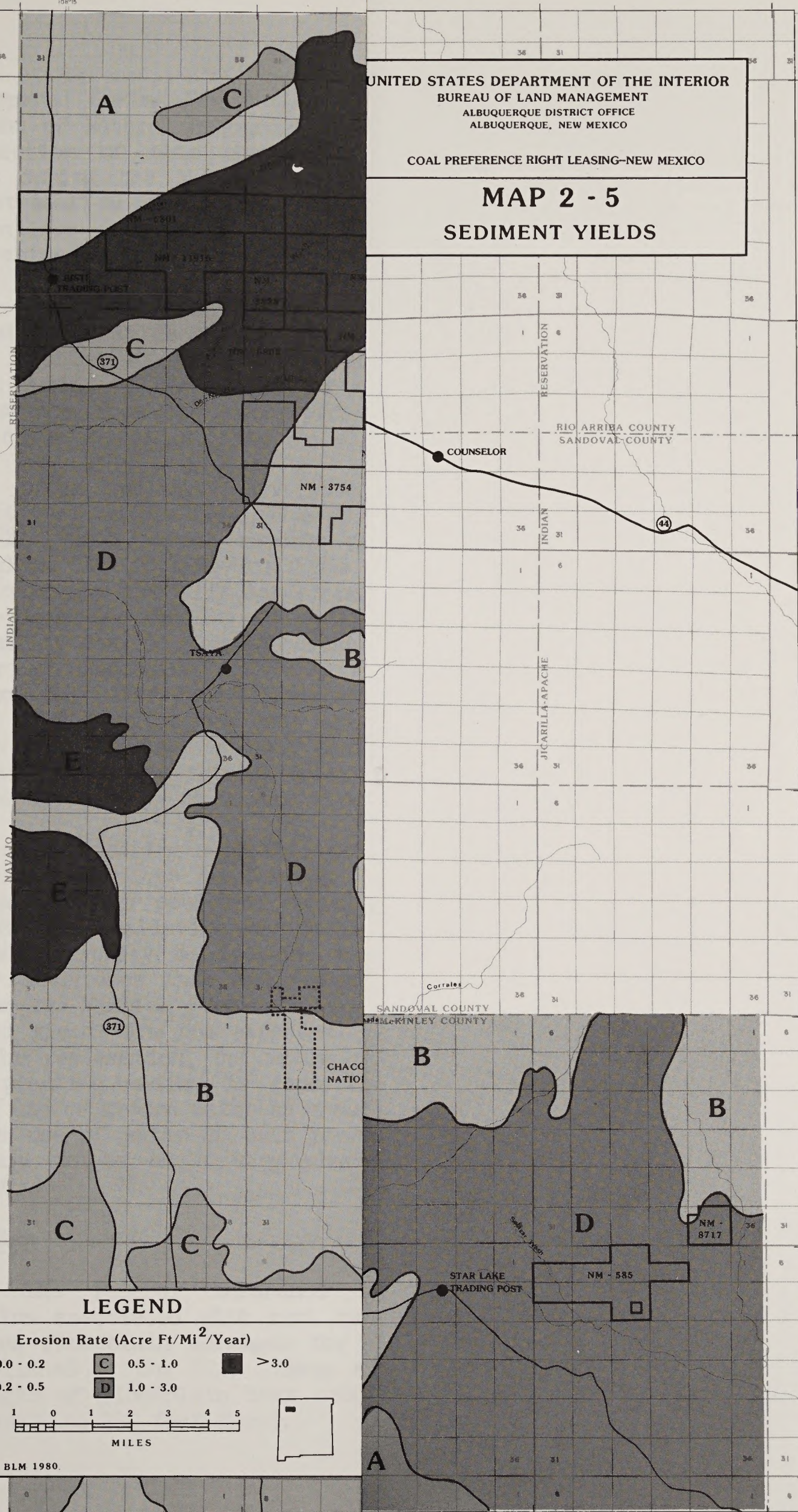
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ALBUQUERQUE DISTRICT OFFICE
ALBUQUERQUE, NEW MEXICO

COAL PREFERENCE RIGHT LEASING-NEW MEXICO

MAP 2 - 5 SEDIMENT YIELDS



LEGEND

Erosion Rate (Acre Ft/Mi²/Year)

A

0.0 - 0.2

C

0.5 - 1.0

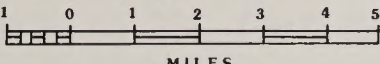
> 3.0

B

0.2 - 0.5

D

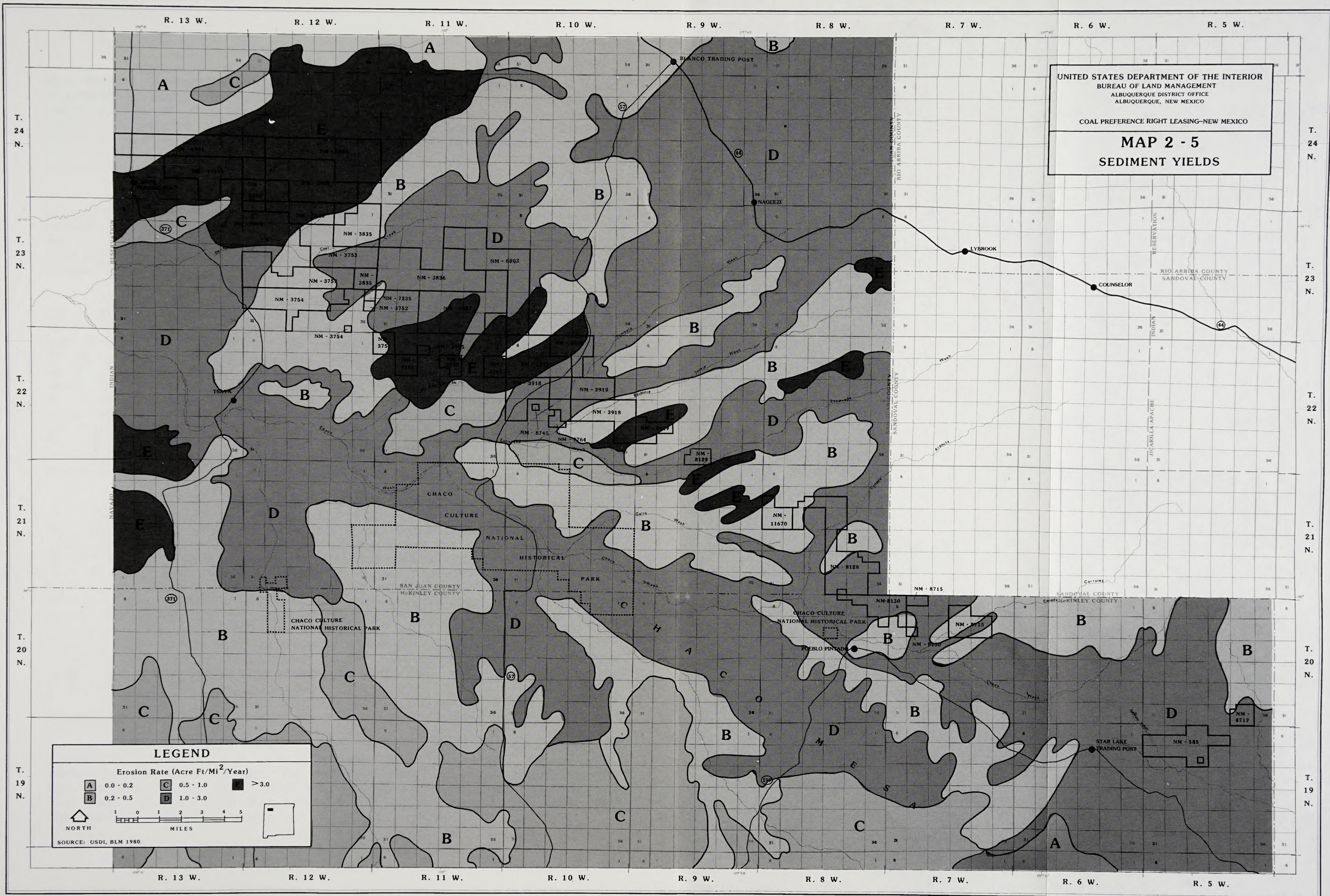
1.0 - 3.0



MILES



SOURCE: USDI, BLM 1980.



maps prepared during New Mexico's water quality planning process (New Mexico Department of Natural Resources, Surface Water Control Division 1979--see also soils section of this chapter). Sediment transport from source areas is greatest during the initial stages of a flow event when surface runoff and rising streamflow pick up weathered material and windblown deposits. Sediment concentrations are usually lower after the flow has peaked; however, a high concentration of fine clays may continue.

The quality of ground water is also poor in the PRLA Area. While suspended material is not a problem in ground water, dissolved solids are a problem. Table 2-6 summarizes water quality data for the major aquifers in the San Juan Basin. Generally, water quality in any given formation deteriorates with distance from the outcrop. Major ions found in the ground water are sodium, chloride, and sulfate.

Water quality in the immediate vicinity of the PRLAs is discussed in the Bisti West (USDI, BLM, BR & GS 1976) and Kimbeto EMRIA Reports (USDI, BLM, WPRS & GS 1981). These reports present water quality information for wells completed in the Kirtland-Fruitland overburden, the Fruitland coal seam, and the underlying Pictured Cliffs Sandstone. Water quality information for many of the wells depicted on Map 2-4 is on file in the BLM Albuquerque District Office. Water quality for all formations shallower than the Westwater Canyon Member of the Morrison Formation is poor, with the possible exception of the Menefee Formation, the Cliff House Sandstone, and Tertiary sandstones that occur north and east of the strippable coal area. Water quality information is lacking for the deep aquifers in the PRLA Area (Westwater Canyon Member of the Morrison Formation and deeper formations); however, dissolved solids will be near or above the upper range of values given for these aquifers in Table 2-6.

In comparing available water quality information with the recommended criteria in Appendices F-9 through F-11, it is apparent that ground water in the PRLA Area is a poor source of supply for irrigation or human consumption. Wells completed in the alluvium may supply suitable water for human consumption, but yields will usually be low due to the fine-grained nature of the alluvium. Tertiary sandstones that occur northeast of the PRLA Area and the Cliff House Sandstone and Menefee Formation may provide water suitable for irrigation, but high well yields are not expected. The deeper aquifers may produce sufficient yields for reclamation, but water quality for irrigation is poor, particularly if the planting medium is fine-textured and has a high salt content. The existing use of ground water as a supply source for livestock is the most likely long-term use of water of such poor quality. Use of this water for irrigation would have to be on a very short-term basis and, even then, may require treatment.

Floodplains

The Federal Insurance Administration (FIA) has identified the floodplains associated with each major wash in the PRLA Area. Appendix F-12 summarizes floodplain acreages for each wash, based on Flood Hazard Boundary Maps published by the FIA. These acreages are approximate and represent only that length of floodplain that occurs in the strippable coal area (i.e., from coal outcrop to 250 feet deep).

TABLE 2-6

PHYSICAL PROPERTIES AND CHEMICAL QUALITY OF MAJOR AQUIFERS IN THE SAN JUAN BASIN

Aquifer	Silica (SiO ₂)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium & Potassium (Na+K)	Bicarbonate (HCO ₃)	Sulfate (SO ₄)	Chloride (Cl)	Fluoride (F)	Nitrate (NO ₃)	Dissolved Solids	Total Hardness (Units)	pH	Temperature (°C)
Alluvium	4.1-63	0-6.6	4-2,870	0.8-2,040	5.5-12,000	34-1,000	2.5-8,890	2-27,500	0-11	0-439	143-47,100	18-15,500	7.3-8.3	4-21
San Jose Formation	7.6-28	0.02-14	1.6-365	0-67	29-745	120-814	71-1,430	3.2-87	0.2-4.0	0-25	323-2,520	4-1,960	6.5-9.2	9-14
Nacimiento Formation	14-22	0.02-0.58	0-385	0-50	3-2,415	0-478	6.2-5,455	1-145	0-4	0.2-5.7	56-14,150	30-966	6.9	12
Ojo Alamo Sandstone	9.6-39	0-2.1	1.6-548	0-126	23-788	0-888	0.4-2,440	0.8-923	0.3-1.8	0-70	275-4,010	4-1,860	6.5-8.9	2-14
Pictured Cliffs Sandstone	11-20	0-0.24	1.9-425	1-217	50-16,600	209-2,400	7.3-4,400	19-26,600	1.2-5.5	0-8.6	383-44,200	11-1,950	7.4-9.1	3-19
Cliff House Sandstone	2.7-19	0-0.01	2.2-280	0.7-170	26-6,140	0-1,250	350-8,230	7-4,210	0-8.1	0.1-2.5	849-3,120	8-1,600	4.3-8.9	13-18
Menefee Formation	5.1-21	0-1.1	1-168	0-34	8-2,620	92-1,890	1.8-3,930	1.5-956	0-12	0-19	129-7,780	4-534	7.4-9.1	12-21
Point Lookout Sandstone	0.05-39	0-0.31	0-684	0.4-267	13-833	116-826	3.8-3,410	2.2-113	0.2-3.7	0.1-14	149-5,080	5-2,800	7.4-10.0	13-21
Crevasse Canyon Formation	5.5-24	0-3.6	1.3-630	0-245	0.9-1,002	122-1,030	9.2-2,980	1.4-94	0-2.0	0-427	243-4,470	4-3,100	6.8-9.1	12-20
Gallup Sandstone	10-38	0.02-15	1-456	0-268	16-1,690	85-763	17-2,854	4-1,940	0-6.8	0-40	285-4,400	4-2,240	7.2-8.8	9-42
Dakota Sandstone	6.5-42	0-7.8	1.5-330	0.9-103	5.8-1,430	130-1,600	7.8-3,540	6-500	0.1-10	0.1-10	165-5,560	9-1,080	7.2-8.4	13-23
Westwater Canyon Member Morrison Formation	6.2-29	0-4	1.2-373	0.2-188	9.2-1,430	60-1,200	11-3,540	0.8-374	0.1-4	0-200	168-5,560	4-1,700	7.2-9.2	14-52
Bluff Sandstone	7.4-18	0-0.39	7.5-221	2.2-106	24-949	168-898	17-2,380	12-118	0.2-5.1	0.1-18	264-3,760	20-988	7.5-8.3	11-24
Entrada Sandstone	9.1-27	0.09	1.2-262	0.2-64	15-543	83-539	5.8-1,930	5-2,230	0.2-1.6	0-33	196-5,000	4-916	9.2	17
Chinle Formation	3.9-45	0-1.2	0.4-304	0.5-587	1.2-5,740	34-1,150	16-4,110	5-9,590	0.1-5.9	0-129	171-6,410	3-3,170	6.8-9.1	12-20
San Andres Limestone	6.7-23	0-1.2	60-266	14-128	1.2-426	161-702	11-1,030	4-254	0-0.8	0-105	272-2,370	72-1,040	6.7-8.2	11-46
Glorieta Sandstone	8.2-13	3.4-4.1	100-183	15-87	9.2-1,330	184-265	230-637	5-1,980	0.1-0.8	0-1.7	567-4,330	412-779	7.2	13-26

Source: USDI, BLM BR AND GS 1976.

Generally, the floodplains in this area are totally undeveloped. Occasional fencelines cross these floodplains, and occasional wells may draw water from floodplain alluvium. Single-family dwellings are sparse in the PRLA Area; however, these may also occur on floodplains.

WILDLIFE

Approximately 280 species of terrestrial vertebrate wildlife are either known from or may be expected to occur in the PRLA Area (USDI, BLM 1980c). These include 62 species of mammals, 198 species of birds, 18 species of reptiles and 4 species of amphibians.

No fish have been reported in the PRLA Area. A few isolated tanks, reservoirs or ponds may contain fish, but the locations or compositions of such populations are not known.

The above species are supplemented by numerous forms of invertebrates including spiders, scorpions and terrestrial insect forms. Aquatic forms may include amphipod and decapod crustaceans (refer to the Glossary for explanation), snails, worms and aquatic insects, and (usually) larvae of dipterous flies and dragon and damselflies.

Wildlife Habitats

The aquatic medium, 14 upland vegetative sites, and land forms characteristic of the PRLA Area are divided into four broad wildlife habitat types (Kinsky 1977). They are as follows:

- Aquatic (generally temporary)
- Riparian (riverwash-wetland)
- Pinyon-juniper woodland
 - 1. Sandy to shallow-pinyon-juniper
 - 2. Shallow-pinyon-juniper
- Grassland-desert shrub-barren
 - 1. Badlands
 - 2. Dunelands
 - 3. Rock outcrops
 - 4. Badland-rock outcrops
 - 5. Deep sand-grassland-saltbush
 - 6. Treated sagebrush
 - 7. Loamy-sagebrush
 - 8. Loamy bottom-sagebrush
 - 9. Sandy-sagebrush
 - 10. Sodic slopes-grassland
 - 11. Salt flats-halophytic vegetation

The acreages of each vegetative site and land form by PRLA are depicted in Table 2-3 (vegetation section of this chapter). The first three habitat types shown on the list above cover relatively small areas. Aquatic habitats are restricted to a few isolated ponds, reservoirs and watering tanks, most of which become dry during periods of hot, dry weather. During periods of rainfall, some washes and low areas in the PRLA Area contain water for short periods. The riparian habitat is, at best, poorly developed and is limited to thin, often broken or overgrazed belts of vegetation around some ponds and tanks and a few stream washes. Pinyon-juniper woodlands are characteristic of small areas of shallow, well-drained sloping soils and are most common on the eastern PRLAs.

The grassland-desert shrub-barren habitat type covers the greatest acreage within the PRLA Area. Vegetated soils are usually deeper sands with relatively poor drainage. Much of the land has been overgrazed by livestock, and sizable barren areas are common. Some of the terrain is broken by rock outcrops.

Typical extensive and well-defined habitat types have characteristic wildlife species. However, because of the restrictive and limited distribution of the first three habitat types, there may be relatively few characteristic species. The aquatic medium is characterized by many birds, usually migrants, which include ducks and geese and wading species. Other forms include amphibians (at the time of breeding and egg laying) and aquatic insects described above.

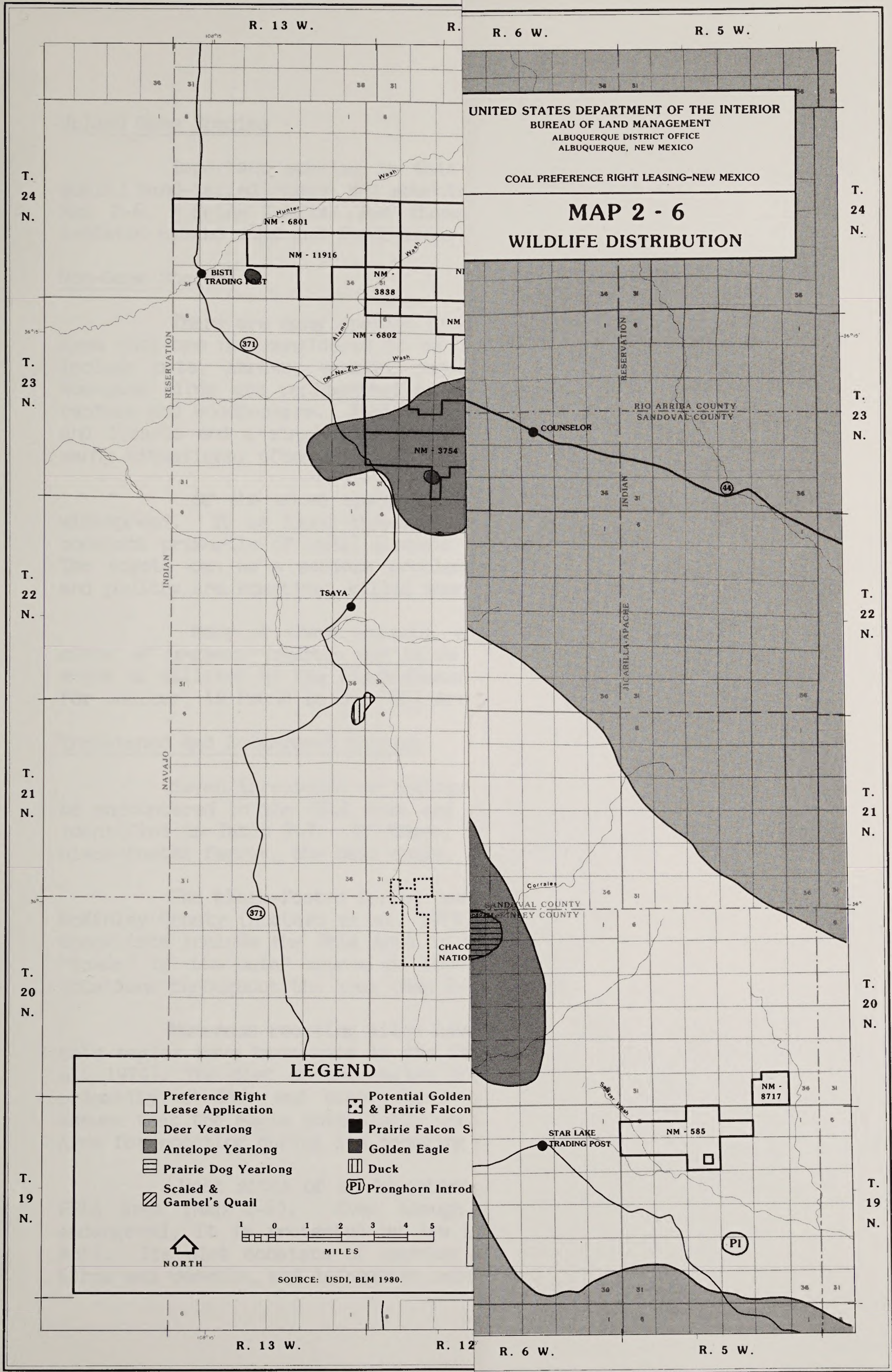
The riparian and pinyon-juniper woodlands habitats in the PRLA Area have few characteristic wildlife species due to their small scattered locations separated by vegetation typical of the grassland-desert shrub-barren habitat type. Riparian and woodland habitats potentially contain more diverse wildlife faunas consisting of numerous small mammals and passerine songbirds that use the vegetation for breeding and feeding grounds and for nesting. Otherwise, their faunas are frequently similar to the grassland-desert shrub-barren habitat. Species typical of the grassland-desert shrub-barren habitat are described below.

Big Game Species

Major wildlife species that may be affected by mining on the PRLAs include two species generally classified as big game: pronghorn antelope and mule deer. Other big game species such as black bear and mountain lion are now rarely found in the PRLA Area. The bobcat, once common, has declined sharply in recent years as a result of pelt hunting and predator control programs (USDI, BLM 1980c). Such species as fox and ringtail cat, often classified as furbearers, are also rarely found in the PRLA Area.

According to a distribution map published by Russell (1964), the PRLA Area is included in historical antelope range. However, by the 1900's, the species was eliminated from much of northwest New Mexico by poaching and overgrazing of range by livestock (Bailey 1932) and, more recently, by mineral developments. Between 1937 and 1956 the New Mexico Department of Game and Fish released a total of 227 antelope in the vicinity of the PRLA Area, (Russell 1964). Map 2-6 depicts locations of antelope releases near the PRLA Area, and the boundaries of yearlong range. There is currently little information on the status of antelope populations in the area of the PRLAs as no census flights have been made in the last five years by the New Mexico Department of Game and Fish (USDI, BLM 1980c).

Mule deer populations in the vicinity of the PRLA Area have been at low levels since the early 1900's. Bailey's 1932 distribution map indicated that deer were present only in the areas lying to the south and north of the PRLA Area, but since then they have been reported in Chaco Canyon and Chaco Mesa by BLM Farmington Resource Area and National Park Service personnel (USDI, BLM 1980c). Map 2-6 shows the current yearlong deer range in the area of the PRLAs. There are no population estimates, and no introductions of this species have been made.



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R. 13 W. R. 12 W. R. 11 W. R. 10 W. R. 9 W. R. 8 W. R. 7 W. R. 6 W. R. 5 W.

T. 24 N.

T. 23 N.

T. 22 N.

T. 21 N.

T. 20 N.

T. 19 N.

T. 24 N.

T. 23 N.

T. 22 N.

T. 21 N.

T. 20 N.

T. 19 N.

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MAP 2 - 6
WILDLIFE DISTRIBUTION

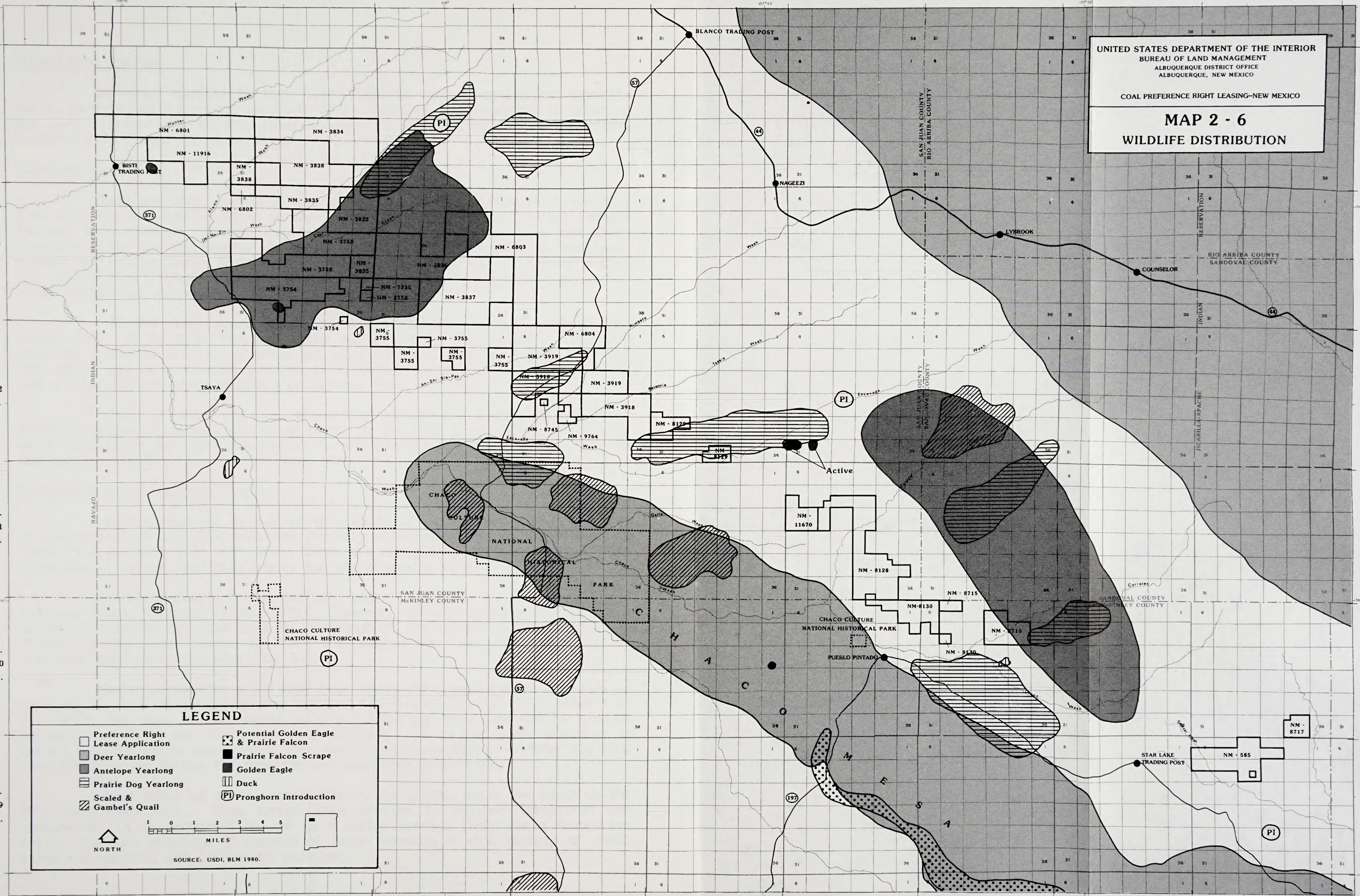
LEGEND

Preference Right Lease Application	Potential Golden Eagle & Prairie Falcon
Deer Yearlong	Prairie Falcon Scrape
Antelope Yearlong	Golden Eagle
Prairie Dog Yearlong	Duck
Scaled & Gambel's Quail	Pronghorn Introduction

NORTH

1 0 1 2 3 4 5 MILES

SOURCE: USDI, BLM 1980.



Upland Game Species

Important species in this classification include scaled and Gambel's quail, band-tailed pigeon and mourning dove. Yearlong quail habitat is shown on Map 2-6. Prime habitat for these species is found along washes or around isolated upland wood and shrub areas.

Non-Game Species

There are many species of mammals and birds found throughout the PRLA Area that are not considered to be big or upland game species. Typical mammals include bats, shrews, skunks, coyotes, gophers, and numerous rats and mice. Non-game birds are represented by wading birds, passerine songbirds, swallows, raptors and woodpeckers. Reptiles are represented by several species of snakes and lizards and a single species of turtle. Toads may be found in some moist, sandy situations, often at great depths during dry seasons.

Of the above species, the coyote is perhaps the most dominant and widespread. It is found throughout the region and in all habitats. Its diet consists primarily of small mammals but also includes some birds and reptiles. The coyote can be a serious problem to livestock owners because lambs, calves and poultry are sometimes killed when natural food is scarce.

Many of these animals, especially rodents and songbirds, enter the diets of predator mammals and birds found in the PRLA Area. The prairie dog, which is utilized by the black-footed ferret directly for food, and its burrows for shelter, is found in the PRLA Area (Map 2-6).

Threatened and Endangered Species

Seven threatened or endangered species of mammals and birds that may be encountered in the PRLA Area and directly affected by mining activities are identified in Table 2-7. Of these, three are considered to be endangered: the black-footed ferret, the bald eagle, and the peregrine falcon.

The black-footed ferret has only been observed in the southern half of McKinley County (Hubbard et al. 1979). However, numerous popular and technical checklists include the PRLA Area in the range of the ferret because burrows or "towns" of its chief source of food, the prairie dog, are found in scattered locations throughout the area (Map 2-6).

Numerous roosting sites have been found and miscellaneous sightings of bald eagles have been made in the San Juan River Basin (Grubb 1979, Hubbard et al. 1979). The diet of the eagles in this region has been observed to consist primarily of deer and other types of carrion. It is therefore possible to assume that the eagle potentially uses some woody areas within or near the PRLA Area for roosting during its foraging and migratory activities.

Nest sites of an important raptor, the golden eagle are known on the PRLA Area (Map 2-6). Even though this species is neither threatened nor endangered, it is protected by law as a raptor species (Bald Eagle Protection Act). Its diet consists of carrion of large mammals, a wide variety of small birds and mammals, and infrequent reptiles.

TABLE 2-7

THREATENED AND ENDANGERED VERTEBRATE SPECIES

Class: species	Listings ^{a/}	Season of Use	Status	Sightings ^{b/}
<u>Mammals:</u>				
Black-footed ferret (<u>Mustela nigripes</u>)	F, S-I	Yearlong	Endangered	2H', 2R? from McKinley County (Hubbard et al., 1979); additional records from McKinley County cited by Dimas (pers. comm. 1981).
<u>Birds:</u>				
Mississippi kite (<u>Ictinia mississippiensis</u>)	S-II	Vagrant	Threatened	1R, 1R? from San Juan River Basin (Hubbard et al., 1979)
Bald eagle (<u>Haliaeetus leucocephalus</u>) ^{c/}	F, S-II	Winter, migrant	Endangered	1R, 1H from McKinley County (Hubbard et al., 1979); numerous sightings and nest records from San Juan River Basin (Grubb, 1979; Hubbard et al., 1979)
Peregrine falcon (<u>Falco peregrinus anatum</u>)	F, S-I	Yearlong	Endangered	1R', 4R from San Juan River Basin (Hubbard et al., 1979)
Red-headed woodpecker (<u>Melanerpes erythrocephalus caurinus</u>)	S-II	Summer	Threatened	1R', 1R from San Juan River Basin (Hubbard et al., 1979)
Baird's sparrow (<u>Ammodramus bairdii</u>)	S-II	Migrant	Threatened	1R' from San Juan River Basin (Hubbard et al., 1979)
McCown's longspur (<u>Calcarius mccownii</u>)	S-II	Migrant	Threatened	May be expected on the PRLAs (USDI, BLM 1980)

Notes: ^{a/} Listings: F-Federal; S-State; S-I, those species whose prospects of survival or recruitment in the state are in jeopardy; S-II, those species whose prospects of survival or recruitment in the state are in jeopardy in the foreseeable future.

^{b/} Sightings: H'- verified record, pre-1960; H - unverified record, pre-1960; R'- verified record, 1960 or later; R - unverified record, 1960 or later.

^{c/} The golden eagle (Aquila chrysaetos) is considered to be neither endangered nor threatened, but is afforded protection by the Bald Eagle Protection Act (16 U.S.C. 668-668d). For suitable habitats, locations and recorded nesting sites refer to Map 2-6.

Peregrine falcons may possibly fly over the PRLA Area while foraging. The diet of this species consists primarily of various birds, including ducks and geese, swallows, woodpeckers and numerous songbirds. Most of these species may be found in the PRLA Area at some time of the year. Many of these prey species use the area for breeding, feeding and nesting activities.

LIVESTOCK GRAZING

As shown on Map 2-7, portions of 12 allotments within the Chaco Planning Unit and a portion of the Navajo Indian Irrigation Project (NIIP) are included in the PRLA Area.

The complex surface ownership pattern in the area has severely limited livestock management by the BLM. The public land blocks with little or no Indian allotted lands interspersed are currently managed by the BLM (Section 3 or 15 administration--refer to the Glossary for definition). Five allotments in the PRLA Area are administered by the BLM.

Allotments with small scattered tracts of public lands are administered by the Bureau of Indian Affairs (BIA) through a cooperative agreement dated September 15, 1978. On these allotments the BLM has set carrying capacities for the public lands within the allotment. The BIA leases these allotments (under Section 15 administration) to the Navajo Tribe in two units, called the Adobe Lease and the PLO 3662 Lease. The BIA administers seven allotments in the PRLA Area, two of which are tribal ranches administered and managed by the Navajo Tribe. Administration of grazing allotments within the PRLA Area is as shown in Table 2-8. (Refer to Table 2-9 for more detailed allotment information, including allotment acreage, grazing qualifications, class of livestock, and season of use.)

Because of the complex land patterns and special rulings under which the BIA allotments are administered, the BLM has no knowledge of actual livestock operators, livestock numbers, class of livestock, or range developments on many of these allotments.

Livestock grazing has been historically, and is presently, the primary use of the area. The majority of allotments (nine) in the PRLA Area are community allotments grazed primarily by Navajo stockmen living in or near the area their livestock graze. As shown on Table 2-9, all allotments within the area are grazed yearlong. Grazing of all classes of livestock (cattle, sheep, horses and goats) is authorized on the nine BIA and/or Navajo Tribe administered allotments. On the remaining three allotments only cattle graze.

Only one allotment in the PRLA Area is grazed under a BLM Allotment Management Plan (AMP). The Tsaya AMP (No. 6012) was initiated in 1970. Livestock Animal Unit Months (AUMs) were reduced from 1,944 to 1,497 in February 1971, and 36 AUMs were reserved for wildlife. A 1975 allotment evaluation indicated a definite improvement in range condition on the allotment, primarily as a result of good plant vigor and proper utilization. Range condition continues to improve on the allotment at the present time. Valid range condition and trend data on the remainder of the allotments do not exist at the present time.

TABLE 2-8

ADMINISTRATION OF GRAZING ALLOTMENTS
IN THE PRLA AREA

Allotment No.	Name	Grazing Administration
6008	Bisti Community	Section 15-BIA-Adobe Lease
6009	Eli Smith	Section 15-Navajo Tribe-PLO-3662
6010	Black Lake (Paragon Resources)	Section 3-BLM
6011	Otis Community	Section 15-BIA-Adobe Lease
6012	Tsaya	Section 3-BLM
6013	Kimbeto Community	Section 3-BLM
6015	Counselor Community	Section 3-BLM
6016	Lake Valley Community	Section 15-BIA-PLO-3662
6017	Chaco Canyon	Section 15-Navajo Tribe-PLO-3662
6018	Pueblo Pintado Community	Section 15-BIA-PLO-3662
6019	M. Tanner - Chaco Energy	Section 15-BLM
6023	Star Lake Community	Section 15-BIA-Adobe Lease

Source: USDI, BLM 1980.

R. 13 W.

R. 6 W.

R. 5 W.

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COAL PREFERENCE RIGHT LEASING-NEW MEXICO

MAP 2 - 7 GRAZING ALLOTMENTS

Navajo Indian Irrigation Project

BISTI TRADING POST

6008

(371)

6009

6012

Alotment Mana
(AMP) BLM

TSAY

6016

6015

6022

6021

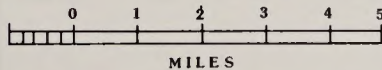
6023

6034

STAR LAKE TRADING POST

LEGEND

- Preference Right Lease Application
- Section 3 Permit - BLM Administration
- Section 15 Permit - BLM Administration
- Section 15 Permit - BIA Administration
- Private Ranch - No BLM Grazing License



SOURCE: USDI, BLM 1980.

R. 13 W.

R. 1

R. 6 W.

R. 5 W.

T. 24 N.

T. 23 N.

T. 22 N.

T. 21 N.

T. 20 N.

T. 19 N.

T. 24 N.

T. 23 N.

T. 22 N.

T. 21 N.

T. 20 N.

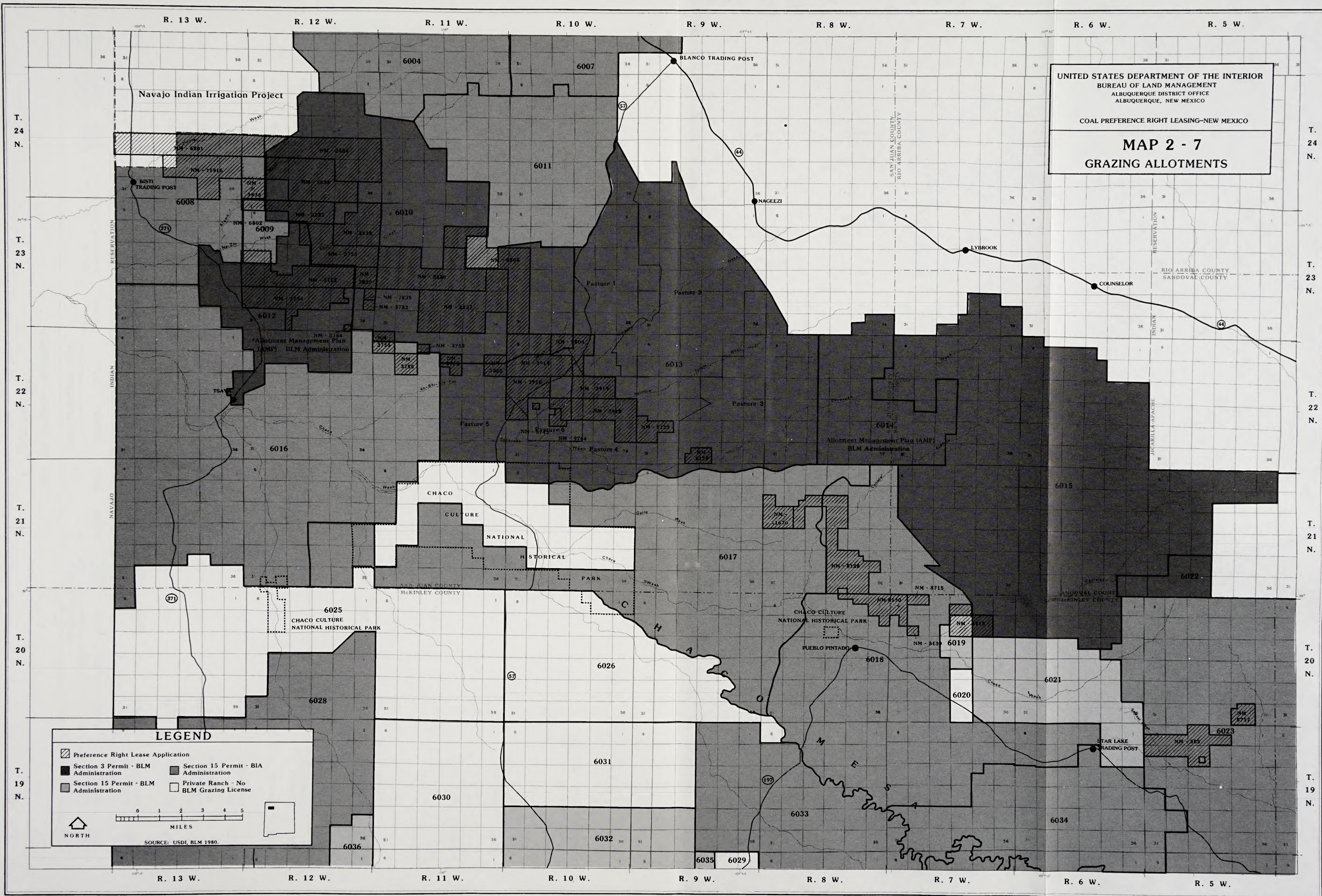
T. 19 N.

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Source: USDI, BLM 1980.



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COAL PREFERENCE RIGHT LEASING-NEW MEXICO

MAP 2 - 7
GRAZING ALLOTMENTS

LEGEND

Preference Right Lease Application	Section 3 Permit - BLM Administration	Section 15 Permit - BIA Administration
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0 1 2 3 4 5
MILES

SOURCE: USDI, BLM 1980.

NORTH

On most of the community allotments within the area, the majority of operators are individual Navajo family units who run small bands of sheep and goats. Many operators reside on or near the allotment which their livestock utilize, and herd their sheep and goats to and from dwellings daily. This grazing pattern creates heavy over-utilization in a circular area close to the dwelling, decreasing with increased distance from the residence. Range condition on many of these allotments is considered poor and in a downward trend as a result of heavy stocking rates, poor distribution, and yearlong use. Until these grazing management practices are changed, poor to deteriorating range conditions will continue.

As mentioned in Chapter 1, 75,510 total acres are involved in the PRLA Area. Refer to Appendix G-1 for acreages involved by allotment and PRLA number, and to Appendix G-2 for vegetative types and estimated AUMs by PRLA and allotment. Map 2-8 shows range developments known to exist on the PRLA Area.

RECREATION

Recreation use on the 50,188 acres of public land (of the total 75,510 acres) in the PRLA Area is limited to dispersed recreation activities. Dispersed recreation includes those outdoor recreation activities that occur outside areas that are intensively managed to facilitate concentrated recreational use. Recreation activities occurring in the PRLA Area are: (1) hunting - big and small game, (2) collecting vegetation, (3) back country use, (4) sightseeing opportunities such as zoological, geological, historical, and archeological, and (5) off-road vehicle use (USDI, BLM 1980c).

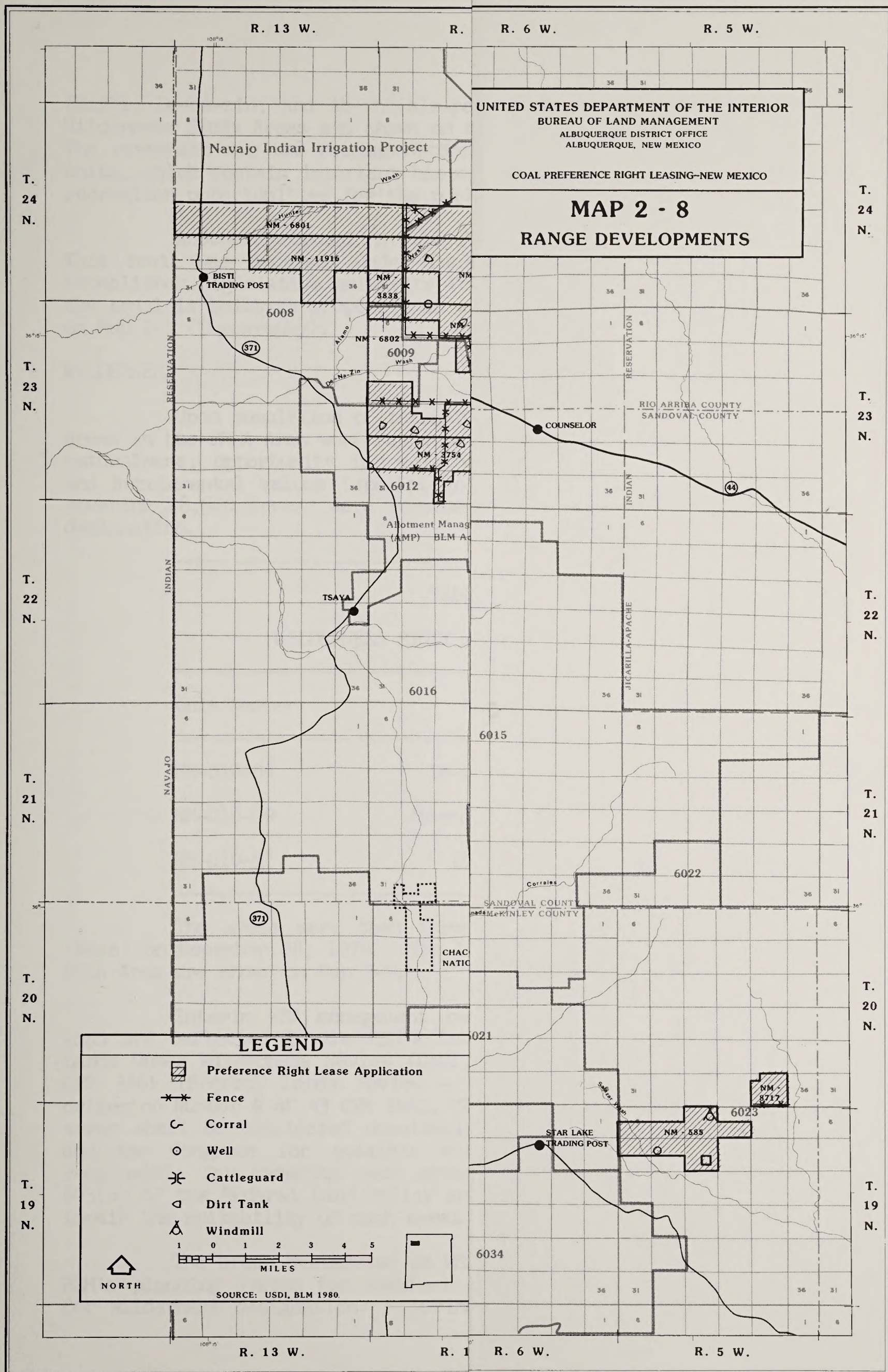
Recreation use in the PRLA Area cannot be quantified. However, 179,235 activity occasions (refer to the Glossary) were projected to have occurred on public lands in the Chaco Planning Unit in 1980. The 50,188 acres of public land in the PRLA Area make up approximately 9 percent of the total public lands in the Planning Unit. The Planning Unit in general has not been an area of high recreation use (USDI, BLM 1980c). This can be attributed to the area's remote location, the relatively low population, the lack of highly desired recreation resources, and the difficulty experienced in traveling the majority of rough unmarked roads. The lack of use, open spaces, and natural conditions are considered by some individuals as a recreation value in themselves.

Most recreation use that is experienced in the area occurs in the spring and fall. Summer use is minimal.

One notable exception to this use pattern occurs in the Chaco Culture National Historical Park, which receives the majority of its visitor-use during the summer months. The park, run by the National Park Service, also provides the only developed recreation facilities in the immediate area of the PRLAs. There were approximately 48,000 visitors to the Park in 1979 (USDI, BLM 1980c).

Access for a majority of the visitors to the Chaco Culture National Historical Park is provided by State Highway 57. This road extends across approximately six miles of the PRLA Area north of the park.

Three areas have been recommended for designation as Areas of Critical Environmental Concern (ACECs) under the recreation program in the Management Framework Plan of the BLM's planning system (USDI, BLM 1981). The three areas



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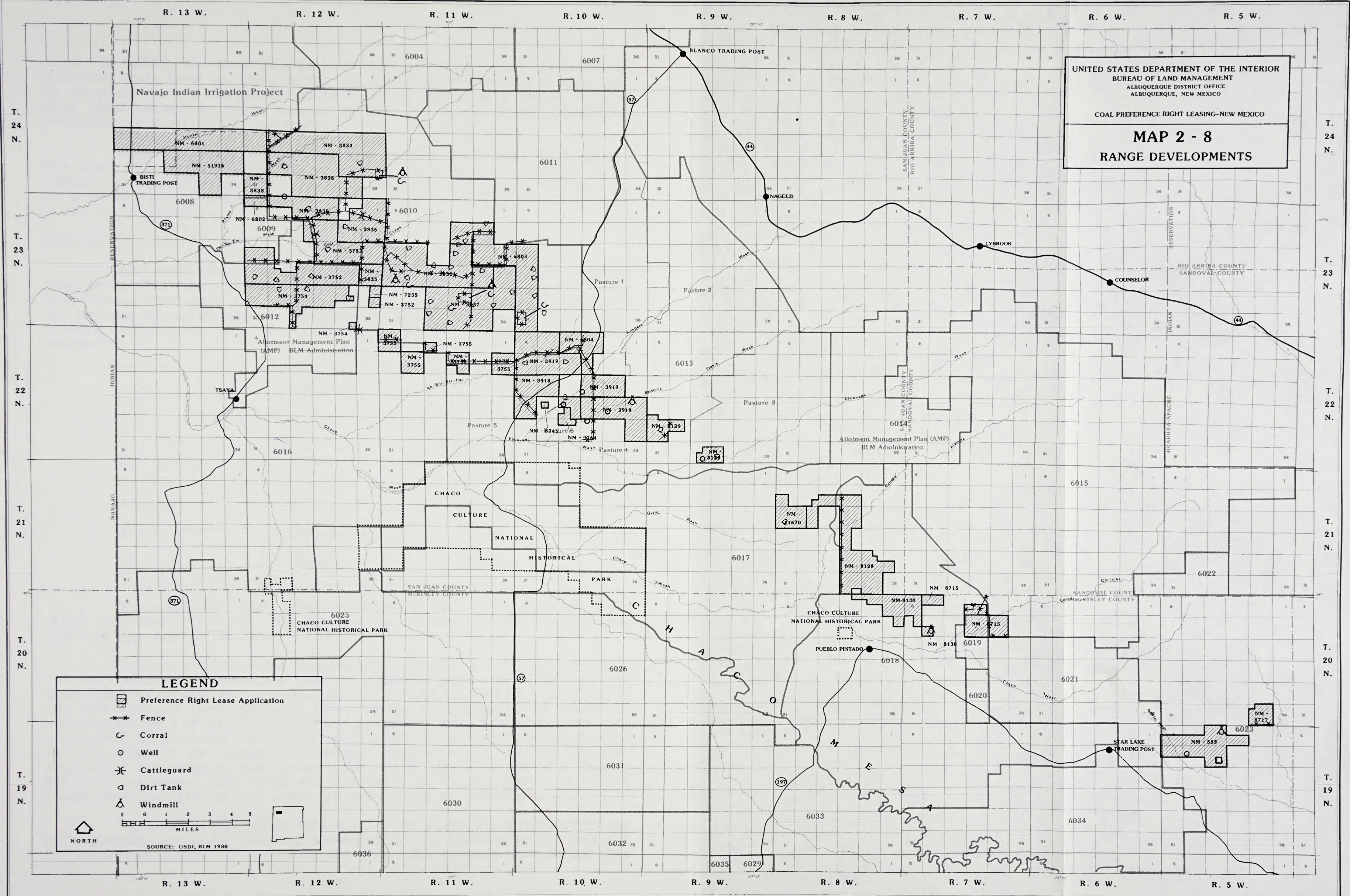
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(Bisti, De-na-zin, and Ah-shi-sle-pah) are the same three areas designated as Wilderness Study Areas and shown on Map 2-9 (refer to next section of this EA). The rationale for the recommendation is to prevent irreparable damage to these units, which contain important historic cultural and scenic values, and provide recreation opportunities for the public.

Another proposal in the PRLA Area is the Continental Divide Trail. This trail was proposed under Public Law 90-543 of October 2, 1968, which establishes legislative authority for a national system of hiking trails. If the trail is built as proposed, it would follow the Continental Divide as shown on Map 2-1 (Topography).

WILDERNESS

Upon completion of intensive inventory in August, 1979, three roadless areas in the PRLA Area were found to exhibit wilderness characteristics of size, naturalness, opportunity for solitude or primitive and unconfined recreation, and supplemental values (special geologic and scenic features). These areas, covering 28,520 acres, were recommended to be studied for possible wilderness designation.

TABLE 2-10

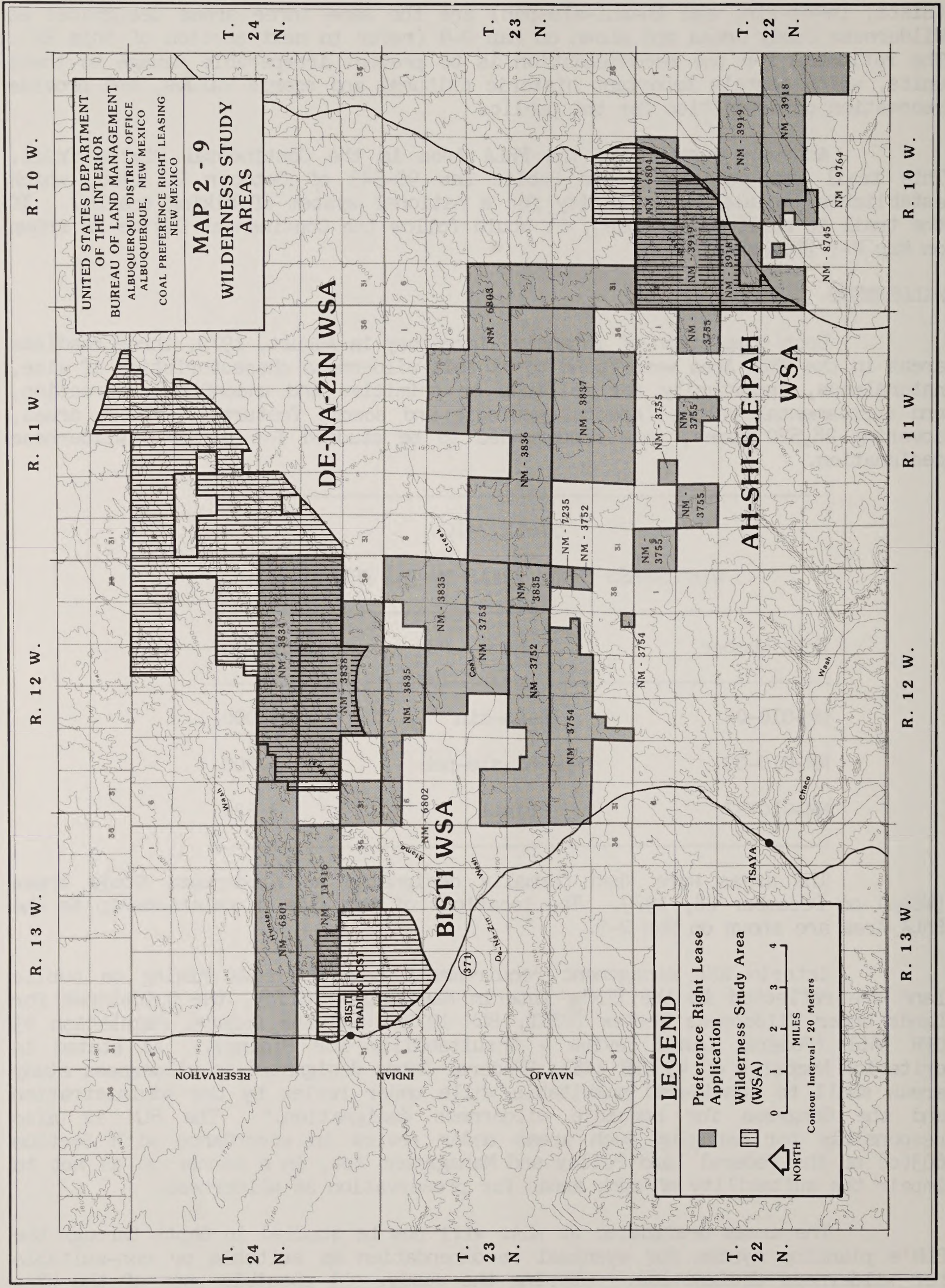
WILDERNESS STUDY AREAS IN THE PRLA AREA

Unit Number	Name	Acreage
NM-010-04	De-na-zin	19,000
NM-010-09	Ah-shi-sle-pah	6,000
NM-010-57	Bisti	3,520

The areas were then formally designated as Wilderness Study Areas (WSAs) on December 28, 1979. The locations of the WSAs in relationship to the PRLA Area are shown on Map 2-9.

Interim WSA management requirements covering coal mining on public land are reflected in the BLM's Interim Management Policy, the Guidelines for Lands Under Wilderness Review (USDI, BLM 1979a) and the federal regulation 43 CFR 3461 (Federal Lands Review - Unsuitability for Mining). As stated in criterion Number 4 of 43 CFR 3461, "Federal lands designated as wilderness study areas shall be considered unsuitable while under review by the Administration and the Congress for possible wilderness designation." The BLM is also responsible for managing such areas under review in accordance with Section 603(c) of the Federal Land Policy and Management Act, in a manner so as not to impair the suitability of such areas for preservation as wilderness.

The areas designated as WSAs will now be studied in depth through the BLM's planning system for eventual recommendation as suitable or non-suitable for wilderness designation. During the study, all possible uses of the WSAs



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NEW MEXICO

MAP 2 - 9
WILDERNESS STUDY
AREAS

LEGEND

	Preference Right Lease Application
	Wilderness Study Area (WSA)
	NORTH
0 1 2 3 4 MILES	
Contour Interval - 20 Meters	

DE-NA-ZIN WSA

BISTI WSA

AH-SHI-SLE-PAH WSA

T. 24 N.

T. 23 N.

T. 22 N.

R. 10 W.

R. 11 W.

R. 12 W.

R. 13 W.

R. 10 W.

R. 11 W.

R. 12 W.

R. 13 W.

will be evaluated to determine the highest and best use of the areas. At the conclusion of each study, the BLM will file an environmental impact statement (EIS) that will analyze the suitability/unsuitability recommendations derived through the planning system. This EIS is scheduled to be completed by mid-1983. All recommendations will be forwarded to the President and then to Congress; only Congress can make the final wilderness decision. Until such a final decision is made, all WSAs are considered as under review and unsuitable for mining.

CULTURAL RESOURCES

Archeological Sites

The BLM has completed three major studies of cultural resources in the San Juan Basin since 1978. Table 2-11 summarizes the contracting groups, levels of inventory, and areas surveyed in these studies. Humans have been in the Basin for a very long period of time - 10,000 years, and site density is high. The comparative isolation of the Basin from the present mainstream of American culture has preserved the archeological record of earlier cultures comparatively intact. This record contains evidence of a long sequence of major cultural developments, but the full magnitude of the area's socio-economic complexity is just beginning to be known.

Despite the efforts that the BLM has made to date, the full extent of the cultural resources in the PRLA Area is not known because of the large amount of land that is involved and the lack of intensive inventory data. The BLM has contracted a study by ESCA-TECH Corporation of Costa Mesa, California, that involves the development of a computer model to predict site locations and densities on the PRLA Area. This model is based on environmental data from earth satellite imagery and cultural data from 1,174 site reports made in six recent surveys near the PRLA Area. The areas of the six surveys used for this predictive model are shown on Map 2-10. The reliability of the site density projections is now being field-checked. Data from this study is expected to be available for inclusion in the Final PRLA EA.

Some cultural resource inventories of the PRLA Area have been carried out by other private companies for various activities. In addition, the BLM inventoried one-and-a-quarter sections of the area during the Bisti-Star Lake Class II Project (USDI, BLM 1978). Table 2-12 identifies the percentage of each potential lease area that has been inventoried and the number of archeological site localities that have been recorded.

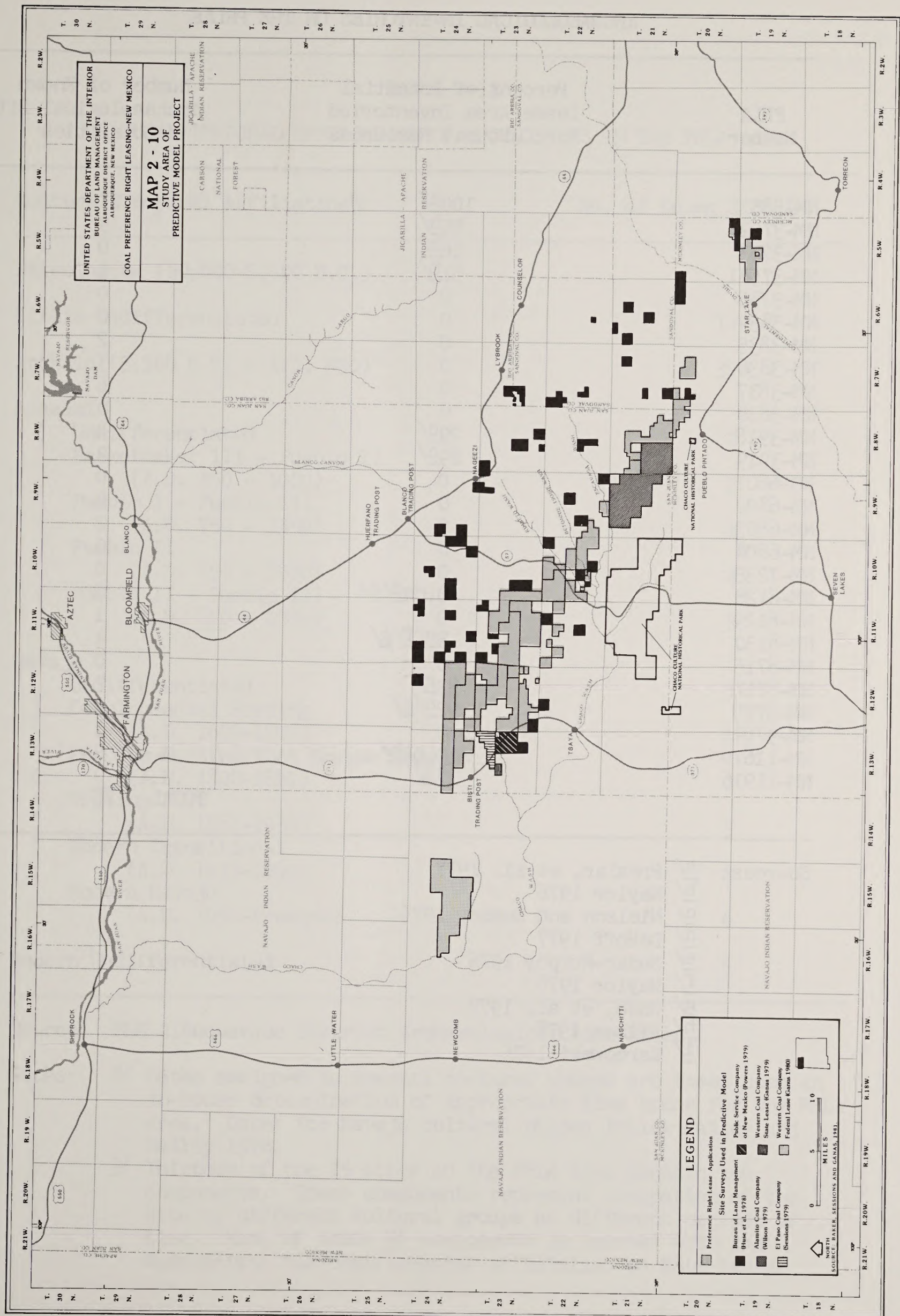
The size of about three-quarters of the 75 identified site localities on the PRLA Area is known. Size ranges from a low of 3 square meters to a high of 4 acres. Half of those for which size is known are larger than 1,000 square meters and five are 150,000 square meters or larger. Limited information on site condition is available for about half of the 75 identified site localities. Of those evaluated, 35 percent are listed in the available records as being in good condition, 26 percent in fair condition, and 39 percent in poor condition.

The cultural groups associated with known sites in the PRLA Area are identified in Table 2-13. Approximate temporal affiliations of the sites are also shown in this table. As would be expected, the oldest period is the least well represented; only one Paleoindian artifact has been identified on the PRLA

TABLE 2-11

BLM CULTURAL RESOURCES INVENTORIES IN THE SAN JUAN BASIN

Date	Contract Holder	Author and Title of Report	Level of Inventory	Area of Inventory	Acreage Surveyed	Number of Survey Units
1979	New Mexico State University, Las Cruces	Magers: <u>A Class I Cultural Resources Inventory of the Chaco, San Juan and Portions of the Cabezón Planning Units</u>	Class I (A review and synthesis of existing cultural resource information)	San Juan Basin within New Mexico and southern Colorado	0	0
1978	Archeological Associates Inc., Boulder, Colorado	Huse et al.: <u>The Bisti-Star Lake Project - A Sample Survey of Cultural Resources in Northwestern New Mexico</u>	Class II (Identification and recording of all surface sites within a portion of a defined area)	Public lands in central San Juan Basin	12 percent sample of 37,610 acres	62 parcels
1981	Museum of Northern Arizona, Flagstaff	Delaney and Dosh: <u>A Class II Cultural Resources Inventory of the Southern Portion of the Chaco Planning Unit, McKinley and Sandoval Counties, New Mexico</u>	Class II (Identification and recording of all surface sites within a portion of a defined area)	Public lands in southern San Juan Basin	11 percent sample of 22,160 acres	35 parcels



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ALBUQUERQUE, NEW MEXICO

MAP 2 - 10
STUDY AREA OF
PREDICTIVE MODEL PROJECT

LEGEND

Preference Right Lease Application

Site Surveys Used in Predictive Model

- Bureau of Land Management (Buse et al. 1978)
- Alamogordo Coal Company (Wilson 1979)
- El Paso Coal Company (Sensous 1979)
- Public Service Company of New Mexico (Powers 1979)
- Western Coal Company (State Lease Gains 1979)
- Western Coal Company (Federal Lease Gains 1980)

0 5 10
MILES

NORTH
SOURCE: BAKER, SENSOUS AND GANAS, 1981

TABLE 2-12

ARCHAEOLOGICAL INVENTORIES ON THE PRLAs

PRLA Number	Percent of Potential Lease Area Inventoried for Cultural Resources	Number of Known Archaeological Site Localities
NM-585	100 ^{a/}	27
NM-3752	45 ^{b/}	9
NM-3753	16 ^{b/}	0
NM-3754	51 ^{b/}	3
NM-3755	0	0
NM-3834	0	0
NM-3835	0	2
NM-3836	0	3
NM-3837	0	6
NM-3838	0	0
NM-3918	29 ^{c/}	4
NM-3919	29 ^{c/}	2
NM-6801	0	0
NM-6802	0	0
NM-6803	0	2
NM-6804	0	0
NM-7235	0	0
NM-8128	0.04 ^{d/e/}	0
NM-8129	0	1
NM-8130	8 ^{e/f/g/}	4
NM-8715	0	0
NM-8717	53 ^{g/}	7
NM-8745	92 ^{c/g/}	4
NM-9764	0	1
NM-11670	0.04 ^{h/}	0
NM-11916	17 ^{i/}	0
	TOTAL	75

Sources: ^{a/} Preslar, et al. 1977
^{b/} Naylor 1976
^{c/} Nielson and Bussey 1976
^{d/} DeHoff 1977
^{e/} Sudar-Murphy 1976
^{f/} Naylor 1978
^{g/} Huse, et al. 1978
^{h/} Wilson 1978
^{i/} Zarnowski 1976

TABLE 2-13

CULTURAL/TEMPORAL AFFILIATION OF KNOWN SITES IN THE PRLA AREA

Cultural/Temporal Affiliation ^{a/}	No. of Known Sites ^{b/}
Paleoindian (10,000-5,500 B.C.)	1
Lithic Undifferentiated	12
Archaic (5,500 B.C. - A.D. 450)	39
Anasazi	
Undifferentiated	2
Basketmaker III - Pueblo II (A.D. 450 - 1000)	2
Pueblo I - Pueblo III (A.D. 750 - 1350)	1
Pueblo II (A.D. 850 - 1000)	2
Pueblo II - Pueblo III (A.D. 850 - 1350)	3
Navajo	
Undifferentiated	8
Developmental Herding (A.D. 1696-1800)	1
Herding-Raiding/Post Bosque Redondo (A.D. 1800-1881)	0
Trading Post (A.D. 1881-1933)	3
Modern Transitional (A.D. 1933-1950)	3
Modern Navajo (A.D. 1950-Present)	6
Modern Undifferentiated	5

Source: BLM Albuquerque District Archaeological Site Files.

Notes: ^{a/} Dates assigned to Anasazi cultural phases are based upon an in-house determination of appropriate time spans for the PRLA Area. Dates for Navajo cultural phases follow Bailey and Bailey 1978.

^{b/} Thirteen of the 75 sites on the PRLA Area contain two components. These components represent occupation of the site by different cultural groups at different periods of time. Each of these 26 components is counted with the appropriate cultural/temporal affiliation on this table.

Area. This was a fragment of a Folsom point, a type used for hunting a large species of Ice Age bison.

Archaic sites account for 44 percent of known sites, the largest single category on the PRLA Area. (The term "Archaic" refers to groups of mobile small-game hunters and gatherers. The Archaic period covered a time span of approximately 6,000 years.) Irwin-Williams (1973) has divided the Archaic in northwestern New Mexico into five temporal phases, but the data available on Archaic sites in the PRLA Area is not sufficiently detailed to enable making these distinctions.

The term "lithic" which appears on Table 2-13 does not actually refer to a cultural category. Lithic sites contain stone tools or weapons, or stone flakes resulting from the manufacturing process. The term is applied when the archeologist recording the site is unable to identify any distinguishing characteristics that would make it possible to assign a cultural or cultural/temporal affiliation to the site. Judging from recent inventories nearby, the majority of sites identified as lithic on the PRLA Area are probably Archaic. If lithic and Archaic sites are combined into a single group, they total 58 percent of the known sites.

Archaic sites tend to be associated with dune areas and are sometimes uncovered by the wind, although many of them are probably not presently visible on the surface. Once generally ignored these sites are now receiving more attention. Efforts are being made to identify the different functional site types, which include implement manufacture, plant procurement, and plant processing. This analysis of site function is enabling archeologists to better understand the types of locations used by Archaic people and some of the economic factors in their selections.

Anasazi sites represent 11 percent of the total known sites on the PRLAs. Anasazi culture is divided into smaller temporal phases known as Basketmaker II and III and Pueblo I through Pueblo IV. (Table 2-13 lists the number of sites in the temporal groups identified in the site reports.) The Basketmaker phase of Anasazi culture marks the transition from small bands of people using the natural food resources available in the region to the beginnings of an agricultural-based economy. The Pueblo phases are marked by the development of permanent villages of solid masonry construction.

The concentration of populations in the Basin during Pueblo times was possible because of increased levels of food production. Because the climate of the PRLA Area was probably similar in A.D. 1000 to what it is today, the ability of the Anasazi to raise sufficient food in this windy arid region more than a mile above sea level is evidence of their horticultural knowledge as well as an awareness of soils and terrain.

Anasazi sites best known to the public are the large multi-story pueblos of the so-called "Chacoan Phenomenon". The Chacoan Phenomenon involves numerous communities throughout the San Juan Basin associated with a central complex of large communities at Chaco Canyon. The largest of these, Pueblo Bonito, has the distinction of having been the largest communal structure in the world until the end of the 19th century (Irwin-Williams 1972).

The importance of the communities within Chaco Canyon has been recognized for a long time; the area has been a National Monument since 1907. In late 1980 Congress passed P.L. 96-550, which designated the monument as the Chaco Culture National Historical Park. This act authorized some adjustments in the boundaries of the former monument (refer to Map 2-10 for new boundaries).

One of the major reasons for passage of P.L. 96-550 was concern for protection of the numerous outlying communities now thought to be associated with Chaco Canyon. More than 70 of these communities or "outliers" have now been identified, and 33 of them are designated as Chacoan Archeological Protection Sites under P.L. 96-550. Two of these protection sites, Bisa'ani and Pierre's Ruin, share portions of their boundaries with portions of the PRLA boundaries. Both of these sites are on the State Register of Historic Places. National Register nominations have been made for a 960-acre Pierre's Ruin Archeological District and a 1,280-acre Bisa'ani Archeological District.

The proposed Pierre's Ruin Archeological District includes three town structures, nine villages, and nine limited use areas dating from early Pueblo II to early Pueblo III. The BLM manages the surface of 640 acres of the proposed district. The proposed Bisa'ani Archeological District, which is located on Navajo Tribal Fee land, contains two towns dating from the peak period of Chacoan town building. This proposed archeological district is on a tract of land presently under lease to a coal company, but it has been excluded from mine development areas.

An awareness of the existence of the Chacoan Phenomenon has come only within the last 10 years. Verification of the major outliers has come within the last 3 years (Marshall et al., 1980), and it is now believed that this complex of outliers was connected to Chaco Canyon by a road network. Approximately 400 miles of the road network have now been identified on aerial imagery and many segments have been verified on the ground (Obenauf, 1980). This road system is shown on Map 2-11. The most complete ground verification has been carried out on the so-called "Great North Road", which runs 50 miles from Chaco Canyon to Salmon Ruins near Farmington, New Mexico.

The full extent of this prehistoric road system is not known. Aerial imagery has been taken for many areas of the Basin. However, not all of this imagery, including much of the PRLA Area, has been studied for evidence of Chacoan roads. The length of road segments that have been identified on aerial imagery as crossing proposed lease areas are shown on Table 2-14. In addition, a 2.6 kilometer road segment is known to closely parallel a boundary of one of the proposed leases. It is not yet known where many of these segments lead, so their true length cannot be judged. A projection has been made of the distances involved if all imaged segments do actually extend across proposed lease areas. These projections are also given on Table 2-14. Two of the proposed leases could be crossed by as many as three separate roads, and two other proposed leases may each be crossed by two roads.

The BLM is currently conducting an in-house study of the prehistoric road system (Robertson 1981). The SHPO, the NPS Division of Cultural Research, and the State of New Mexico Laboratory of Anthropology are represented on the steering committee for this BLM Chaco roads project. Aerial imagery of the PRLA Area will be searched during this study. The importance of studying the road system probably does not lie in a goal of preserving all of the roads as

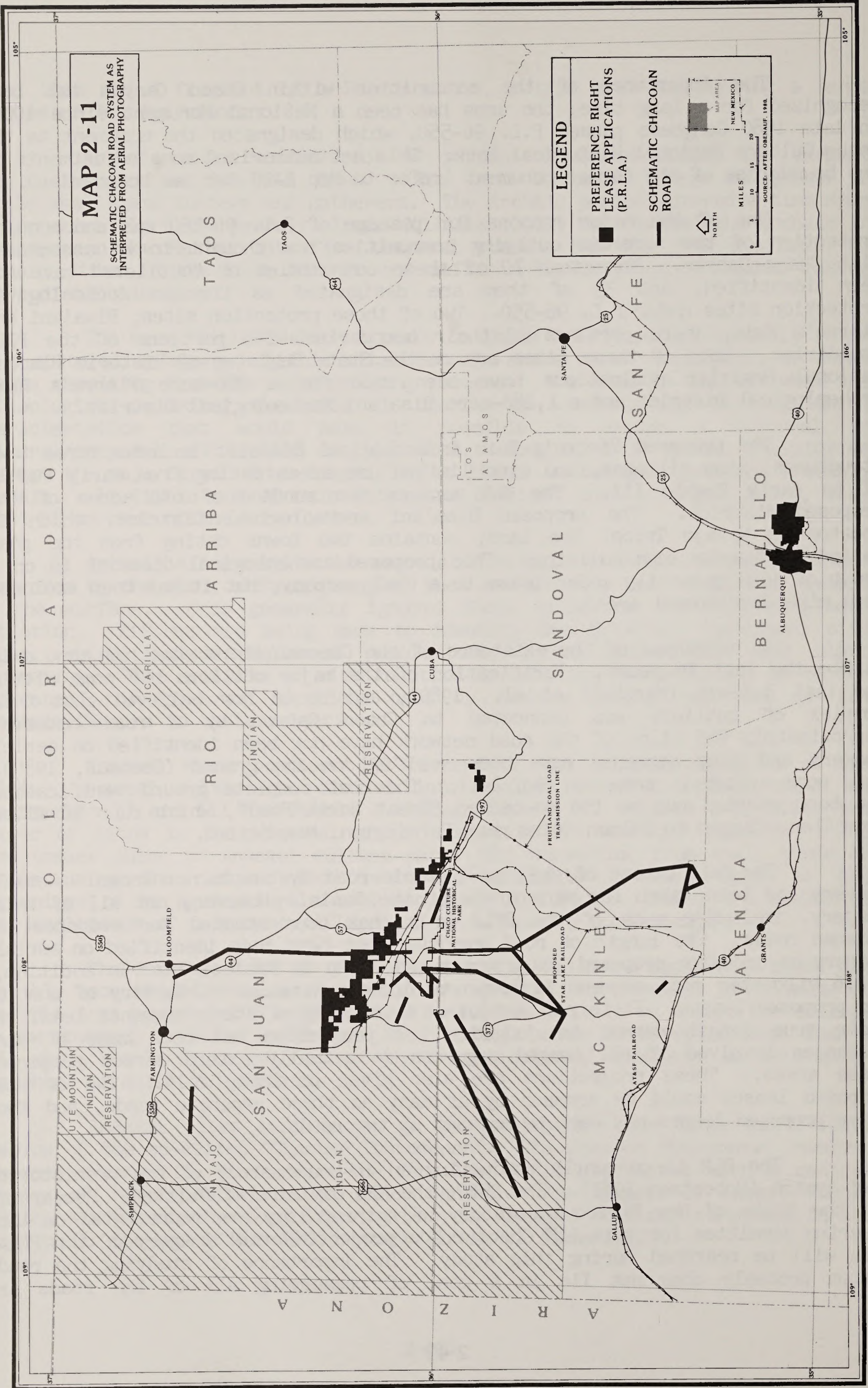


TABLE 2-14

POTENTIAL CHACOAN ROADS CROSSING THE PRLA AREA
(in kilometers)^{a/}

PRLA Number	Projected Segments	Imaged Segments
NM-3752	2.30	0
NM-3755	1.50	0.10
NM-3835	1.75	0
NM-3836	9.90	0
NM-3837	0	3.20
NM-3918	5.85	0.90
NM-3919	6.30	0
NM-6801	2.00	0
NM-6803	3.60	2.25
NM-6804	2.05	0
NM-8129	0.35	1.00
NM-8130	1.60	0
NM-8715	1.60	0
NM-8745	0	1.00
NM-9764	0.40	0.15
NM-11916	<u>2.90</u>	<u>0</u>
TOTALS	42.10	8.60

Source: Data compiled from aerial photo imagery interpreted and transferred to USGS 7.5 minute topographic quads by Obenauf. Original quads on file at National Park Service, Division of Cultural Research, Albuquerque, NM.

Note: ^{a/} 1 kilometer = 0.621 mile.

monuments, because there is little to be seen on the ground of most segments. It is, however, important to know where the roads go, so it can begin to be understood how they were used. It is theorized that food may have been transported for storage at Chaco Canyon, then redistributed as needed during times of crop failure. Whatever the case, the roads do indicate the existence of a complex socio-economic system.

In addition to the archeological record described above, the San Juan Basin contains still other major archeological resources. The Anasazi, who left the central basin for as yet unexplained reasons, were later replaced by the Navajo people. The Navajo sites identified on Table 2-13 represent 24 percent of the known sites on the PRLA Area. The earliest identified Navajo site on the PRLAs falls within the historic period documented in Brugge's recently published, A History of the Chaco Navajo (1980). The majority of modern undifferentiated sites on the PRLAs (Table 2-13) are probably Navajo sites. If these sites are combined with known Navajo sites, the total represents 30 percent of all identified sites on the PRLAs.

The possible eligibility of sites on the PRLAs for inclusion on the National Register of Historic Places has not yet been determined. It is believed that some historic Navajo sites will be eligible, as well as some sites from older cultural periods. Historic Navajo sites could include the earliest chapter house, some battle sites and some rock art panels (Brugge and York, personal communications 1980). Pierre's Ruin, already nominated to the National Register for its scientific values, also has historic values to the Navajo as a refuge during the Ft. Sumner Period (Fransted n.d.). The BLM is evaluating evidence for the existence of trails used by Puebloan tribes just before the historic period began, and an historic trail used by a Mormon colony on the Rio Puerco. If verified, these trails may also meet criteria for Register eligibility.

Gravesites

Graves form another type of important cultural site in the PRLA Area. Modern graves are known to exist on the PRLAs, and historic and prehistoric graves are assumed to exist. Locations for more than eight graves have been identified during interviews held by the BLM with the Navajo residents in the area. The exact number of burials at these locations is not clear. One informant referred to a large general area believed to contain many burials. Some of the informants who identified the locations of burials have fenced these graves so that they will not be inadvertently disturbed. One individual commented that the idea of reburial would be like having two funerals for one person, stating that these are people who have been put to rest and they should not be disturbed. However, the Navajo Nation does allow and even endorses reburial as a mitigation measure.

While locations of more recent burials are known to relatives, the identification of older gravesites is often difficult. Some graves are in hogans that were abandoned after the death occurred. Some graves are marked by a pile of poles or rocks, but such markers may have been removed. Other graves are marked by what may appear to the uninformed as simply discarded objects. Older gravesites are often located in crevices or rocky places.

Sacred Sites

As set out by the American Indian Religious Freedom Act of 1978 (92 Stat. 469, 42 USC 1996), "It is the policy of the United States to protect and preserve for American Indians their inherent right of freedom to believe, express and exercise the traditional religions . . . including but not limited to access to [sacred] sites" It is known that some 280 Navajo traditional religious practitioners are active in the area covered by the BLM's Chaco Planning Unit.

A series of interviews has been held with 14 of these traditional religious practitioners and one practitioner in the Native American Church. These interviews were conducted in the native language by Navajo employees of the BLM. Those interviewed included officials of the Navajo Medicine Men's Association and practitioners living within and outside the PRLA Area. The purpose of these interviews was to assess the range of issues falling under the Indian Religious Freedom Act that could be affected by the proposed leasing for coal development.

The Navajo believe in many deities, who were physically present on the earth at an earlier time. According to sacred traditions, the Navajo will continue to exist as a people as long as they maintain a correct way of life within the four sacred mountains marking the boundaries of the area designated for them by the deities. Most Navajo consider these mountains to have great heritage value to the tribe. One of these mountains, Mt. Taylor, is a prominent landmark within an area of energy development in the southern portion of the Basin.

The most sacred Navajo ceremonial sites are locales of events in which the deities participated. This includes events of both general ceremonial significance and more particularized occurrences, such as the founding of Navajo clans. The major sites are usually associated with prominent natural features, but some are associated with Chacoan outliers. The BLM has identified 12 Navajo sacred sites within the Basin. Although not as widely known to all Navajo as the four sacred mountains, these sacred sites are well known to most Navajo within the area. The BLM has not identified any major sacred site on the PRLA Area, but Fransted (n.d.) has indicated that the Bisa'ani outlier, which is immediately adjacent to one of the proposed leases, may be considered a sacred area.

Sites sacred to other tribes may also exist in the general area. It is known that the Zuni Tribe does have an important ceremonial site 300 miles distant from its present reservation boundaries.

In addition to the major sacred areas associated with Navajo lore, individual religious practitioners have sacred areas that have become consecrated through use. These are locales at which individual practitioners make offerings and prayers for beneficial reasons, such as the bringing of rain and the cessation of sandstorms. Offering points are generally associated with distinctive natural features, such as a butte or mesa on the flats. More than one religious practitioner may use a single offering point, but in general these locales are private and known only to the user. Six practitioners specifically mentioned that offering points may be near hogans and that the hogans themselves should also be considered as being sacred because of the prayers that have been offered there.

Gathering areas are another important ceremonial concern. In the Navajo belief system, illness is the manifestation of disharmony that has occurred through failure to follow the proper guidelines for behavior. Patients are cured by restoring this harmony through ritual means. The use of wild herbs is an important element in these curing ceremonies. Some of the plants gathered for ceremonial use are widespread (e.g. snakeweed, greasewood, fourwing saltbush, and sage) but others may be uncommon and difficult to locate. Certain other kinds of natural resources are gathered for ceremonial use as well, including minerals for the sand paintings used in curing ceremonies.

Navajos continue to hold traditional religious ceremonies fairly regularly. The PRLA Area has been one of the more isolated areas until recent years and the continuance of traditional values is important to people living there. Some of the teenagers attending BIA schools occasionally speak of a desire to become traditional religious practitioners. It has been documented that occasional participation in traditional ceremonies also remains important for Navajos earning high salaries and living in urban areas (Robbins, 1978). The performance of one elaborate ceremony often costs several hundred to over one thousand dollars. The continued investment of such sums of money is evidence of the importance of the traditional belief system to many Navajo people.

PALEONTOLOGY

The fossil-bearing rock units within the PRLA Area belong to the Upper Cretaceous Fruitland and Kirtland Formations. Paleontologic studies of these formations, carried out since the 1880's, have shown that Fruitland and Kirtland strata contain many valuable remains of dinosaurs and other reptiles, mammals, invertebrates, and plants. A complete listing of all currently known fossil taxa from these formations is presented in Appendix B of the Star Lake-Bisti Regional Coal Final Environmental Statement (USDI, BLM 1979).

Recent general inventory surveys (Kues et al. 1977; Le Mone and Harris 1977) and current BLM intensive inventories of paleontological resources within and near the PRLA Area confirm the abundance and high quality of many Fruitland/Kirtland fossils. Fossil occurrences reported from these inventories are presented in Table 2-15. This table shows the number of fossil occurrences for each PRLA, with importance values assigned to each occurrence. The importance values used here are those defined by Kues et al. (1977, pp. 163-166) and are explained in Appendix H.

Within the PRLA Area, there are 1,137 known fossil occurrences. Of this number, 3 are Class I, 77 Class II, 418 Class III, and 639 Class IV. However, inventory data are lacking for eight PRLAs and are substantially incomplete for five. Before an adequate assessment of the paleontological resources of these 13 PRLAs can be made, these areas must be more thoroughly inventoried. Five of the PRLAs (NM-3752, NM-3753, NM-3835, NM-3919, and NM-6804) contain fossil localities that are presently under long-term scientific study by the BLM's Albuquerque District Office in cooperation with the New Mexico Bureau of Mines and Mineral Resources.

Based on paleontologic data from surface exposures of the Fruitland and Kirtland Formations, it can be assumed that the subsurface strata of these formations in the PRLA Area may contain equally important plant and animal fossils. However, the extent to which this assumption is valid cannot be determined before the subsurface rocks are exposed.

TABLE 2-15

NUMBER AND IMPORTANCE VALUES OF FOSSIL OCCURRENCES

PRLA No.	Class I (Critical- Mitigation or Protection Essential)	Class II (Highly- Important-Mitigation Strongly Recommended)	Class III (Important- Mitigation Recommended)	Class IV (Insignificant- Mitigation Optional)
NM-585 a/	1	8	60	130
NM-3752				
NM-3753				
NM-3754				
NM-3755 a/				
NM-3834	2	6	21	19
NM-3835				
NM-3836 a/				
NM-3837 a/				
NM-3838				
NM-3918 a/	2	6	17	22
NM-3919				
NM-6801				
NM-6802				
NM-6803 a/				
NM-6804	2	22	136	176
NM-7235 a/				
NM-8128				
NM-8129				
NM-8130 a/				
NM-8715 a/	1	3	5	30
NM-8717 a/				
NM-8745 a/				
NM-9764 a/				
NM-11670 a/				
NM-11916	1	4	12	19
	1	1	2	5
TOTALS	3	77	418	639

Sources: Kues, et al. 1977; Le Mone and Harris 1977; USDI, BLM Inventory Files 1980.

Note: a/ Inventory data either not available or substantially incomplete.

VISUAL RESOURCES

In accordance with the Visual Resource Inventory and Evaluation System (USDI, BLM 1978), three scenic quality classifications are used by the BLM for evaluation purposes. The assignment of a particular classification is based on the combination of outstanding landform (or lack of it), vegetation, and structural rating features in the landscape. These three scenic quality rating classes (USDI, BLM 1980c) are:

Class A - Areas that combine the most outstanding characteristics of each rating factor.

Class B - Areas in which there is a combination of some outstanding features and some that are fairly common to the physiographic region.

Class C - Areas in which the features are fairly common to the physiographic region.

These three classifications, each of which is found in the PRLA Area, are shown on Map 2-12. The classifications are identified by scenic quality rating units delineated in the 1980 Unit Resource Analysis for the BLM Albuquerque District's Chaco Planning Unit.

The amount of acreage by scenic quality classification that occurs within each PRLA is shown in Table 2-16. As shown in this table, 77 percent (58,396 acres) of the PRLA Area is classified as having C-Class scenery or a low scenic value. Approximately 21 percent (15,511 acres) is classified as having A-Class scenery or a high scenic value. The remaining 2 percent (1,603 acres) is classified as having B- Class scenery or a moderate scenic value.

Based on guidelines identified in BLM Manual 8411 and from the New Mexico State Office, those lands having A-Class scenery or WSA classification would receive a Visual Resource Management (VRM) Class II designation. (Each VRM class describes a different degree of modification allowed in the basic elements - form, line, color and texture - of the characteristic landscape. For Class II areas, changes caused by management activities should not create contrasts in the basic elements evident in the landscape.) The WSAs will be managed as VRM Class II pending a final designation. VRM classifications will not be completed on other lands in the PRLA Area until the BLM's Management Framework Plan is approved.

The PRLA Area receives minimal recreation use with the intent of viewing scenery. However, the area is visible from heavy use travel routes such as State Highways 57, 371, and 197; the community of Pueblo Pintado; high points within Chaco Culture National Historical Park; and some residences scattered near the PRLAs. Some of the PRLAs are located within the foreground/middleground distance zone of these more heavily used travel routes and populated areas.

R. 13 W.

R. 6 W.

R. 5 W.

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
ALBUQUERQUE DISTRICT OFFICE
ALBUQUERQUE, NEW MEXICO

COAL PREFERENCE RIGHT LEASING-NEW MEXICO

MAP 2 - 12 SCENIC QUALITY

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LEGEND



Preference Right Lease Application



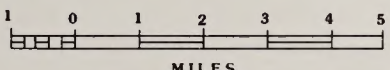
Scenic Quality Rating Unit Identification Number

Scenic Quality Rating

Unit Boundary



NORTH



MILES

Contour Interval - 20 Meters

SOURCE: USDI, BLM 1980.

R. 13 W.

R.

R. 6 W.

R. 5 W.

VISUAL RESOURCES

In accordance with the Visual Resource Inventory and Evaluation System (USDI, BLM 1978), three scenic quality classifications are used by the BLM for evaluation purposes. The assignment of a particular classification is based on the combination of outstanding landform (or lack of it), vegetation, and structural rating features in the landscape. These three scenic quality rating classes (USDI, BLM 1980c) are:

Class A - Areas that combine the most outstanding characteristics of each rating factor.

Class B - Areas in which there is a combination of some outstanding features and some that are fairly common to the physiographic region.

Class C - Areas in which the features are fairly common to the physiographic region.

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The PRLA Area receives minimal recreation use with the intent of viewing scenery. However, the area is visible from heavy use travel routes such as State Highways 57, 371, and 197; the community of Pueblo Pintado; high points within Chaco Culture National Historical Park; and some residences scattered near the PRLAs. Some of the PRLAs are located within the foreground/middleground distance zone of these more heavily used travel routes and populated areas.

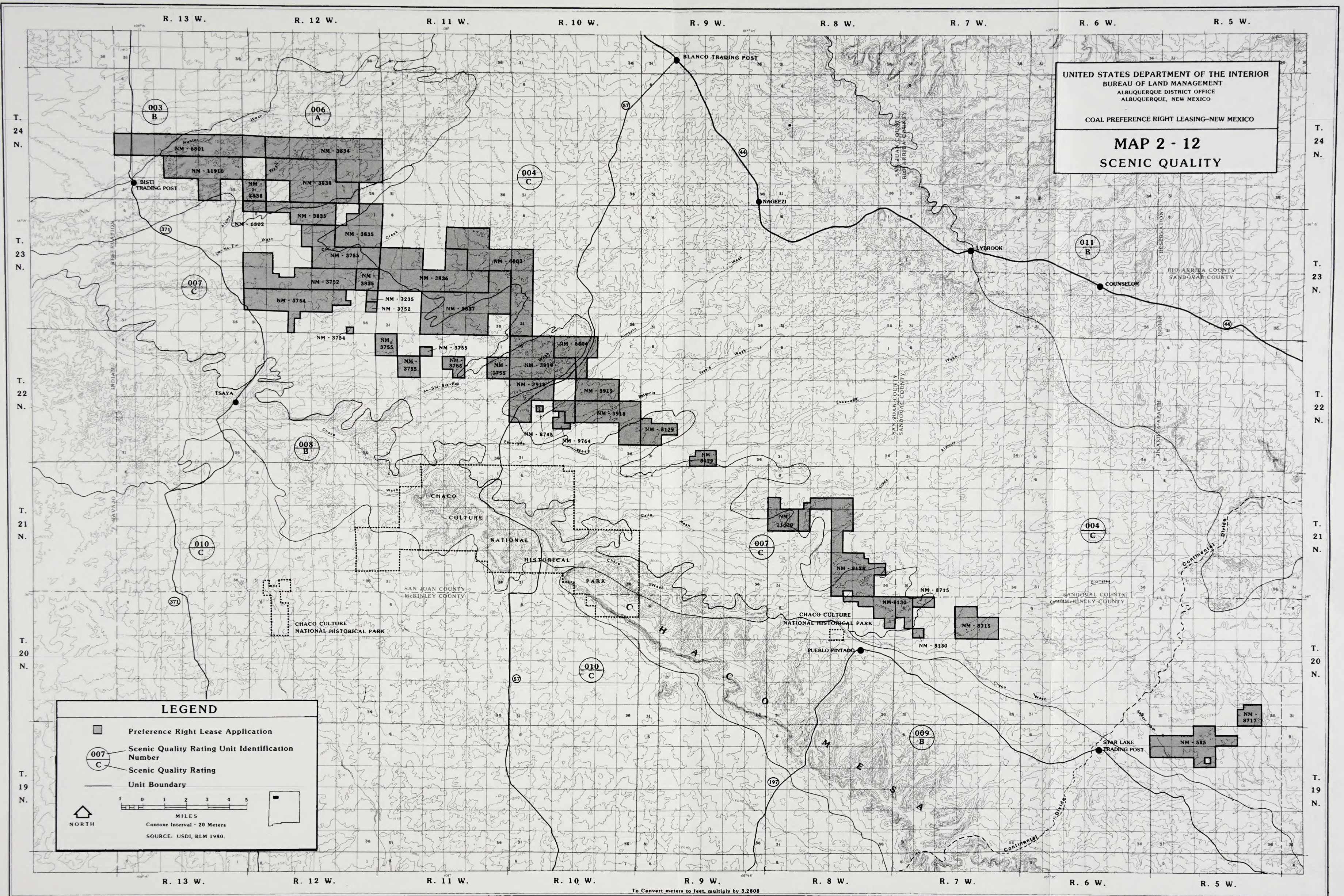


TABLE 2-16

SCENIC QUALITY CLASSES

PRLA Number	Acreage			TOTALS
	Class A	Class B	Class C	
NM-585			2,811	2,811
NM-3752			3,760	3,760
NM-3753			2,951	2,951
NM-3754			3,075	3,075
NM-3755			2,588	2,588
NM-3834	4,804			4,804
NM-3835	349		4,151	4,500
NM-3836			5,110	5,110
NM-3837			5,120	5,120
NM-3838	4,418		369	4,787
NM-3918			4,477	4,477
NM-3919			4,478	4,478
NM-6801	2,791	1,603		4,394
NM-6802	304		36	340
NM-6803			5,121	5,121
NM-6804			1,602	1,602
NM-7235			160	160
NM-8128			4,499	4,499
NM-8129			1,520	1,520
NM-8130			2,133	2,133
NM-8715			1,921	1,921
NM-8717			600	600
NM-8745			520	520
NM-9764			240	240
NM-11670			1,119	1,119
NM-11916	2,845		35	2,880
TOTALS	15,511	1,603	58,396	75,510

SOCIAL AND ECONOMIC CONDITIONS

Introduction

The PRLA Area lies in northeastern McKinley County and southeastern to southcentral San Juan County. Therefore, both of these counties are included in this socioeconomic analysis. Sandoval and Valencia Counties are also included because they contain communities that are within a 75 mile driving distance of the PRLAs and would be influenced by mining development. These four counties are referred to as "the Region."

The Region is characterized by its tri-ethnic culture--American Indian, Hispanic, and White. (This racial/ethnic classification is used in accordance with BLM Washington Office Instruction Memorandum 81-777 in order to refer to a common set of race and national origin definitions.) This tri-ethnic culture results in area cities and communities that differ greatly from each other and contain internal variations as well. Differences exist in social organization, community organization, lifestyles, religious values, and other ethnic and racial precepts.

The PRLAs and immediately adjoining areas are occupied primarily by approximately 30 Navajo American Indian families who graze sheep, cattle and horses on the grass and brushlands. This pastoral lifestyle is traditional and to some extent is the basis of today's Navajo social, economic and cultural system. A few trading posts serve the day-to-day needs of these scattered inhabitants.

Demography

The Region's population is centered around less than a dozen cities or towns, and most of the rural area is sparsely settled. In 1970 the Region's population density was 7.4 persons per square mile, compared to 8.4 for New Mexico and 57.4 for the United States.

The Region's population increased by more than 185 percent between 1950 and 1980, although some counties and cities showed population decreases in the 1960s. In 1950 the Region contained 11.8 percent of the state's population. By 1980 this percentage was 17.8, indicating more rapid growth in the Region than in other areas of the state. This overall rapid growth has resulted from energy mineral and associated development (Refer to Appendix I-1 for county populations by decade for 1950 through 1980. Appendices I-2 through I-6 show further demographic data on the Region's counties and cities).

Their rapid growth has contributed to each of the counties in the Region being designated as energy-impacted counties under Section 601 of the Powerplant and Industrial Fuels Use Act of 1978. The four counties shared (with Colfax County) \$1 million in 1979 and \$2 million in 1980 provided under the act. This funding was used to acquire and develop sites to be used for housing and public facilities.

Some counties and communities have specific growth problems that do not follow the Regional pattern. (Specific demographic data for these cities and counties is shown in Appendices I-1 and I-4.) For example, nearly all of

McKinley and San Juan Counties feel direct influences from present energy-related activity in the PRLA Area. However, only Cuba in Sandoval County and the Grants-Milan area of Valencia County feel these direct influences.

The population of the village of Cuba is 605 people, but within the three-mile planning perimeter there are about 1,110 people (Middle Rio Grande Council of Governments 1980). The Grants-Milan area of Valencia County had a population of 15,198 in 1980, a growth of 38 percent since 1970. This area is made up of two separate cities adjoining one another, each one struggling to meet the needs of the expanding population. Milan, the smaller of the two communities, has had a 68 percent population increase over the past decade.

Although these cities and towns have experienced growing pains in providing services, they have proceeded cautiously in adapting to this growth because they have experienced some boom-bust cycle influences in the past. These cycles, and particularly the rapid growth in some population centers, have brought lifestyle changes to many of the Region's residents. Much of the growth of this area has been as a result of uranium mining, and there has been concern among the local population about recent mine closures as a result of current economic conditions.

Personal Income

The average per capita personal income for the Region increased from \$2,391 in 1970 to \$5,944 in 1978. The per capita personal income figures for the state for comparable years was \$3,045 and \$6,599 respectively. McKinley and San Juan Counties brought the Regional averages down because the 1978 per capita income on the Navajo Reservation was estimated to be about \$2,500 (Navajo Tribe, Native American Research Library 1980).

Personal income figures reported in the New Mexico Statistical Abstract showed a total for the Region of \$640,320,000 in 1976. Agriculture accounted for only 1.6 percent of this income (refer to Appendix I-7). The major nonfarm sources were mining (22.1 percent for the Region, compared to 8 percent statewide), government and government enterprises (19.9 percent), and construction (12.7 percent). Mining is considerably more important for the Region than it is for the state as a whole.

Employment

Figures for 1979 by private employment sector show mining (22.8 percent), retail trade (21.7 percent), and services (16.8 percent) as the major sectors in the Region. Retail trade (24.8 percent) and services (24.1 percent) were also the major sectors for the state, but mining only employed 8.1 percent of those employed in the private sector of the state's population (refer to Appendix I-8).

The average annual unemployment rate for three of the Region's counties are shown in Appendix I-9. These rates were higher than the state average for McKinley and San Juan Counties for most years in the 1970s, but lower for Valencia County. Sandoval County figures are not shown because they are included in the Albuquerque Standard Metropolitan Statistical Area (SMSA) statistics. The SMSA includes Bernalillo County, which is outside the Region being considered in this analysis.

Social Well-Being

Housing

The 1970 census showed levels of substandard housing ranging from 25.7 percent for McKinley County to 8.5 percent for Valencia County. Advance reports from the 1980 census show that the Region has had a 95 percent increase in the number of housing units between 1970 and 1980.

Even with this substantial increase in the number of housing units, the percentage of substandard units is likely to be high. Pressure for housing has kept older homes in use; this is due in part to the increase in population caused by energy development activities. Population per housing unit has decreased substantially in each of the Region's counties, but it is still higher than the state average (refer to Appendix I-10). Housing prices have risen rapidly, and mobile homes are more frequently used.

Health and Medical Services

Health and medical services are inadequate over much of the Region. The New Mexico Health Resources Registry (UNM 1979) showed all four counties as medically under-served areas. The American Medical Association in 1977 indicated a standard of one physician per 620 persons, but none of the Region's counties were near this standard in 1979. Appendix I-11 shows that between 1978 and 1979, the population per physician increased in each county except Sandoval. The Region has a higher population per doctor, dentist, nurse and hospital bed than the State of New Mexico as a whole; the exception is McKinley County with 172 persons per hospital bed, compared with 264 for the state. (It must be kept in mind that many of the hospital beds in McKinley County are provided by the Public Health Service and are available only to the Indian population except in emergencies.) Details concerning medical services and personnel are shown in Appendices I-12 through I-14.

Mortality rates are higher in New Mexico than in the United States as a whole. Cirrhosis of the liver, suicide, and alcoholism contribute to high mortality rates in the Region. Motor vehicle accidents contribute substantially to deaths in the area; in recent years, the deaths per 100,000 motor vehicle miles are higher in the Region than the state average. McKinley County was number one in deaths per 100,000 vehicle miles in 1979 with 12.32 (refer to Appendix I-15 and I-16 for more details).

Family Stability

The dissolution of marriages influences the social well-being of all parties involved, including children. No consistent pattern in dissolutions per 1,000 population is apparent for recent years, except that the rates in the Region were generally lower than the state average rates. Figures for the counties involved can be seen in Appendix I-17.

Crime

Crime detracts from the social well-being of the Region's residents. Rates for violent crimes in 1979 were much higher than the state average in San Juan and McKinley Counties (refer to Appendix I-18). In fact nearly 20 percent of the state's violent crimes for 1979 occurred in the Region. The Region also

produced 13 percent of the state's major property crimes (refer to Appendix I-19), even though the rates per thousand population were below the state average (New Mexico State Police 1980).

Education

The Region's schools and educational facilities also important to the residents' social well-being. Pupil-teacher ratios are near the state average (19.9) and somewhat below the 25 to 1 educational standard established by the state (refer to Appendix I-20). Mobility rates are higher in the Region than the state average except in the Jemez Springs School District. This high rate is characteristic of highly mobile energy-employed populations. Attrition rates in the schools of the Region are also higher than the state average except in Aztec. The 1970 figures for median number of school years completed by persons 25 years old and older shows all four of the Region's counties below the state's 12.2-year average. It is important to note the percentage of the population with 8 years or less of schooling; refer to Table 2-17 below.

TABLE 2-17

PERCENT OF REGIONAL POPULATION BY YEARS OF SCHOOL ATTENDED, 1970

County	No Schooling	8 years or less
McKinley	19.4	24.7
Sandoval	7.9	33.8
San Juan	10.0	21.3
Valencia	4.1	28.6
New Mexico	3.3	24.3

Source: U.S. Dept. of Commerce, Bureau of the Census 1972.

Navajo Cultural-Religious Values

Navajo cultural-religious values are the basis for their day-to-day social well-being. The cultural and religious trends portion of a recent study was summarized in Public Service Company of New Mexico's Western Area Survey (1978). This summary is quoted in full.

The discussion of Navajo "religion" in a separate section does not come from the nature of Navajo religious practices but rather from the tendency of western civilization to compartmentalize and make abstractions of man's various activities. In American culture, one is accustomed to thinking of certain activities as religious, or economic, or political; in Navajo society, these divisions do not necessarily exist nor are they perceived.

In the Navajo language, for example, which is known for making fine distinctions between categories, there is no word for "religion". For Navajos, man, nature and supernatural forces are inextricably interwoven and everyday acts are infused with the concept of the supernatural. Animals, plants, minerals, mountains and places frequented daily can all be endowed with power so that spiritual and supernatural forces surround the Navajo wherever he is and whatever he does.

As in social organization, reciprocity characterized man's relationship with supernatural forces. Just as certain acts are to be avoided in relation to one's relatives, so are certain acts to be avoided vis-a-vis the supernaturals. Traditional Navajo attitudes toward supernatural forces are almost contractual in practice; if the individual follows set formulae in rituals, avoids making errors and avoids "taboos", then the supernatural forces are bound to act positively toward that person. The ideal of traditional Navajos is to be "in harmony" or "walk in beauty", which presupposes active efforts on the part of the individual to secure that relationship with the world around him.

The supernatural forces with which the Navajo are involved include the "holy people" of Navajo mythology and legends. There is no well-ordered hierarchy of these supernaturals and all are powerful, mysterious, and capable of both good and evil intentions toward individuals. Of all the mythological figures, only Changing Woman appears to have had consistently good intentions toward Navajos.

Among the malevolent forces with which the traditional Navajo must contend are "ghosts", the malignant parts of dead persons, either known or unknown, and "witches", living men or women who act alone or as a group to obtain property or produce illness or death. Ghosts are to be avoided. When a person dies in a hogan, the hogan is abandoned, as it is believed that ghosts may want to stay near their former homes. And the possessions of the dead person are buried with him.

Witchcraft has strong roots in Navajo tradition; just as sings and ceremonies and responsibilities to the family have had a leveling effect among Navajos, the possibility of witchcraft accusations have made wealthy Navajos generous (lest they be accused of obtaining their wealth by malevolent means) and have made relatives solicitous of their poorer kin (lest the poor turn to witchcraft against them). Witches (said to do their evil at night dressed in the skins of animals - bear, coyote, wolf) are often called "skin walkers". The possibility of the existence of witches reinforces the necessity of following rituals to stay in harmony since it is essential that an individual have the assistance of supernatural power to overcome witches' intentions. Mysterious deaths, those seemingly without cause, are still often attributed to witchcraft, either because the dead person was "witched" or because the person who died was a witch and was overcome by greater powers.

Sings and ceremonies, performed by Medicine Men or Singers, are more common today than many have thought. The SRC data indicate that 66.1 percent of the respondents attend them while 33.9 percent do not. Most sings are held to overcome or avert misfortune or illness or to secure good fortune or continued well-being. The singer must perform the ceremony precisely, since its effectiveness is dependent on the exactness of his rendition. Since curing is often the aim of sings, there is a complementary aspect between Navajo tradition and American medicine so both may be and are used by Navajos.

As a system of beliefs, the Navajo way is oriented toward the group; absolute moral sanctions against certain types of behavior are not part of the system. Adulterous behavior is not condemned as a violation of a high law but because it will cause trouble with in-laws, for example. Drinking itself is not evil but because children are neglected or money is spent for drink that should be spent for other things, it is condemned according to the traditional Navajo way. The basis for sanctions against certain types of behavior is almost always the immediate consequences of actions to the extended family group.

Perhaps the most surprising findings of the SRC survey was in the area of religious preference. Unlike Anglos who indicate one religious preference, a number of the SRC respondents gave two, three, or even four responses to this question (shown in the Religious Preference table). It may be that Navajos who are accustomed to depending on several sources of income for survival in this world see multiple religious practices as a way of insuring survival in the next. Further analysis of this pattern of responses is necessary.

RELIGIOUS PREFERENCES

traditional Navajo	22.6%
traditional Navajo plus one other religious preference	13.4%
Protestant	20.8%
Native American Church (peyote)	11.3%
Fundamentalist (Navajo Assembly of God, Pentecostal)	9.9%
Catholic	3.5%
LDS (Mormon)	4.8%
no preference or gave three or more religious preferences	13.7%

Source: SRC Study 1975

Regardless of religious preference, the majority of Navajos attend sings and ceremonies. Of those who attend, 28.8 percent go to assist relatives or "help out", 16.1 percent attend because it is their culture or belief; and 13.3 percent go to socialize. Among those who do not attend, the reason given most frequently was that it conflicts with their Christian beliefs or practices.

In general, Navajos who go to sings go to only "a few" that they hear about. They go most often to those held for a member of their immediate or extended family and they help with labor and money.

Despite other changes in Navajo society, traditional practices appear to be strong. Christian and the Native American Church practices preach primary responsibility for one's nuclear family and only secondary responsibility to other kin. These promote a more family-oriented economy, loosen kinship ties and are oriented toward internalized norms rather than group-oriented sanctions. However, even for Navajos who profess belief in these religions, the ties to traditional beliefs and values are quite evident. Navajos, whatever their professed religions, are still strongly bound by tradition to their kinship and community groups through Navajo religious practices. They are influenced by a world view which anchors them within a rich cultural and religious tradition.

Infrastructure

The Planning Division of the New Mexico Department of Finance and Administration has prepared growth management plans by county. These can be referenced for additional county infrastructure information.

Water

Water is supplied to some of the rural areas throughout the Region by individual and community systems. Some of the rural residents have to haul water for domestic and livestock use. All of the major communities within the Region have been making improvements in their water systems, but they still have needs to be met.

Sewer and Storm Drainage Systems

Sewer and storm drainage problems are nearly universal in the Region. The major cities have been improving and expanding the sewage treatment systems but have not completely met the needs. Those cities that have storm drainage systems need to improve and expand them. The smaller communities have sewage lagoon systems; few of these systems are presently adequate for the population and area being served. Septic systems are used in areas outside the city and town service areas. There are areas throughout the Region where the septic system concentration is becoming a problem.

Solid Waste Facilities

Solid waste is handled through municipal and/or private collection and landfill facilities for the larger cities and towns. None of the landfill facilities were reported to have a useful life greater than five years (New

Mexico Health and Environment Department, Health Planning and Development Division 1981). Most of the smaller towns have some kind of landfill facility even though collection is not available.

Transportation

Transportation within the rural portions of the Region is not good; there are but a few miles of improved road and some of the roads are little more than trails. Interstate 40 runs east-west through Valencia and McKinley Counties, crossing the southern part of the PRLA Area. US 666 goes from Gallup to Farmington through the Navajo Reservation but is not near the PRLA Area. State Highways 57 and 371 are the major roads through the PRLA Area. All of the larger communities are working to upgrade their street systems.

Bus transportation (both passenger and freight) is available only along the major highway routes. A few truck lines also serve the freight needs of the area. Rail freight service is available at Gallup and Grants, and plans are developing for a rail line into the PRLA Area. Scheduled air service is available in Farmington and Gallup.

Fire Protection

Fire protection is provided to the major communities within the Region by professionally staffed and reasonably well-equipped fire stations. However, the rapid growth in population has required expansion of facilities. Some of the communities need better distribution of facilities to cut down response times. There are rural volunteer fire facilities in some areas, but much of the rural population is basically without fire protection.

Social Services

Identified social service needs seem to center around the problems of child neglect and lack of day care facilities. These problems are related to both parents working and/or alcoholism in the family. Other recognized social problems include drug abuse, alcoholism, mental illness, wife battering and racial conflict. The communities lack people and funding resources to deal adequately with these problems. Mental health personnel and facilities are generally felt to be inadequate and resources have not kept pace with casework in recent years.

Law Enforcement

Law enforcement in the rural areas is generally the responsibility of the county sheriff and his staff, although in each of the counties there are rural areas where Indian Tribal police officers have jurisdiction. The City Police departments have municipal jurisdiction and the State Police also serve the area.

San Juan County has shown an increase in major crime and reported crimes. This puts increased pressure on the police force. In McKinley County the only category of police activity that has risen steadily over the last 10 years is the protective custody (drunk arrests).

chapter 3

ENVIRONMENTAL CONSEQUENCES

CHAPTER 3

ENVIRONMENTAL CONSEQUENCES

This chapter is an analysis of the impacts that are expected to occur as a result of coal mining on the PRLAs. Technical material that supports this description is located either in the appendix of this document or in the files of the Albuquerque District Office of the Bureau of Land Management (BLM).

AIR QUALITY

Increased emissions of particulates from mines would result from the Proposed Action as development occurred. The major contributors to these emissions would be strip mine operations and transportation of both stripped and underground-mined coal. Population increases would result in increased TSP, SO₂ and NO₂ emissions (USDI, BLM 1979).

Estimates of the magnitude of these increases are not available at this time. As the mining plans are submitted, site-specific environmental analyses will be prepared.

TOPOGRAPHY AND GEOLOGY

Impacts

Unmitigated impacts to the topography and geology of the PRLA Area would depend on whether the coal is removed by surface or underground methods. Map 2-1 shows the areas most likely to be impacted by either of these methods.

In the area most likely to be impacted by surface mining, mine-site preparation would involve some alteration of the natural topography. The total acreage affected would not be known until detailed mining plans are submitted by the potential lessees, but it would be less than 1,000 acres.

The mining phase of the operation would have a much greater impact on topography. The strata overlying the coal beds would be blasted, removed and stored in spoil piles. This would alter the natural landscape of the mined area to a much greater degree than would mine-site preparation. Approximately 22,000 acres would be affected.

Impacts on the topography and geology would not be as great in the area most likely to be affected by underground mining. Leveling, cutting, and filling of exploration drill sites, access roads, and ventilator shafts would cause minor topographic changes.

After the cessation of mining, subsidence would cause some amount of topographic change. Potential deformation from subsidence could include: tension cracks above barrier pillars a few months after mining ceased; compression bulges on the surface about 1¹/₂ to 2 years after completion of mining; and tension cracks as the surface subsided to its final level several years after mining ceased. Rock falls would be unlikely, due to the relatively gentle topography.

Mining exploration plans would have to be submitted by any prospective lessee so that the specific environmental impacts related to the proposed mining

activities could be assessed. The Office of Surface Mining (OSM) would do the environmental analyses when these plans are submitted.

In a typical surface mining operation, about 10 percent of the coal is lost. However, because the coal beds in the PRLA Area are thin and unevenly layered, up to 25 percent of the coal would be lost here.

Approximately 50 percent of the coal in seams mined by the room-and-pillar method is lost in a typical underground mining operation. Approximately 35 percent would be lost in seams mined by the longwall method. (Refer to Appendix I-2 for a description of these mining methods.)

The PRLA Area has been classified as prospectively valuable for oil and gas by the USGS and much of it is covered by oil and gas leases. Simultaneous oil and gas exploration and development can be considered non-compatible with coal mining operations. Drilling for oil through areas that have been surface mined does not present any major technical problems, but drilling through an area that has been underground mined is difficult because drilling fluids are lost in mined-out areas until the drill-holes are cased.

The PRLA Area has a slight potential for uranium deep-mining, because the uranium-bearing Morrison formation lies approximately 3,000-5,000 feet beneath the surface. Numerous mining claims are present on these lands. Any conflicts would have to be settled between the uranium claimant and the coal lessee.

Relationship Between Short-Term Use and Long-Term Productivity

In the short term, approximately 1.15 billion tons of coal would be mined and unavailable for future production. This figure is a sum based upon rough production estimates provided by the applicants. Improvements in mining technology, resulting in higher recovery rates, are likely to occur in the future. Therefore, the extraction of coal in the short term means that less coal would be recovered than if mining was deferred to a future date.

Coal development would make future exploration for (and long-term production of) oil, gas, and uranium more difficult. For example, oil companies do not normally drill for at least 40 years after the cessation of underground coal mining. Surface mining, however, would not result in delays of this magnitude prior to oil and gas development. The use and commitment of the coal resource would involve a trade-off between present energy needs and some delays in the possible future development of other energy resources.

Irreversible and Irretrievable Commitments of Resources

Coal is a nonrenewable resource and cannot be replaced after it is removed by mining. Coal reserves in the PRLA Area would be decreased by about 1.15 billion tons of coal if the applicants carry out their preliminary plans.

Mining would irreversibly and irretrievably commit approximately 22,000 acres to some alteration of the natural topography. Even the required reclamation would not return the landscape to its original contour.

Underground mining would irreversibly and irretrievably commit no more than 30,000 acres to possible subsidence. Subsidence could be expressed as surface deformation, depressions, bulges, or tension cracks.

VEGETATION

Impacts

Under the Proposed Action, approximately 22,625 acres of native vegetation would be removed from the PRLA Area. This figure includes combined total surface disturbance during mine life by all applicants involved in the PRLA Area. Acreages of the various vegetative types that would be removed are shown in Table 3-1.

TABLE 3-1
ACREAGE OF VEGETATION REMOVED

Vegetative Type	Acreage Removed	Percent of Total Area Disturbed	Percent of Total Vegetative Type
Loamy-Sagebrush (L-S)	1,997	9	23
Loamy Bottom-Sagebrush (LB-S)	4,693	21	41
Sandy-Sagebrush (S-S)	527	2	31
Deep Sand-Grassland-Saltbush (DS-GS)	6,751	30	34
Sodic Slopes-Grassland (SS-G)	1,745	8	36
Shallow-Pinyon Juniper (S-PJ)	0	0	0
Sandy to Shallow-Pinyon Juniper (SS-PJ)	0	0	0
Salt Flats-Halophytic (SF-H)	878	4	77
Badlands (BA)	5,954	26	22
Dunelands (Du)	0	0	0
Riverwash-Wetland (RW)	80	<1	15
TOTALS	22,625	100	

Refer to Appendix C-2 for a more detailed breakdown of acreage disturbance by allotment, PRLA number and AUMs involved in the PRLA Area. Additional vegetation losses may occur as a result of subsidence on the underground mined areas.

Vegetative productivity of the area would be lost from the time of disturbance until reclamation is completed. Disturbance/reclamation timeframes are presently unknown and therefore cannot be analyzed at this time. Through reclamation, a shift of vegetation type from shrub to grassland or mixed grassland-shrub is expected to some degree.

Relationship Between Short-Term Use and Long-Term Productivity

In the short term, there would be a loss of vegetation on approximately 22,625 acres in the PRLA Area.

The long-term effect of these short-term uses depends primarily on the success of the soil stabilization and revegetation practices.

Irreversible and Irretrievable Commitments of Resources

Vegetation production on the 22,625 acres to be disturbed by the Proposed Action would be lost until reclamation returns productivity to the level of the present vegetative communities' production.

THREATENED, ENDANGERED, AND SPECIAL INTEREST PLANTS

No impacts.

SOILS

Impacts

Construction of mine facilities (buildings, storage sites, sediment ponds, and haul roads) would cumulatively disturb about 705 acres of surface; approximately 22,020 acres of the PRLA Area would potentially be strip mined. Loss of soil productivity would essentially become permanent on most of the areas used for mine facilities.

Soil structure would be radically altered or destroyed by the surface mining and support activities. These changes would reduce water infiltration rates and water holding capacity, directly limiting vegetation growth and production. Accelerated erosion of exposed soil surface and/or sub-horizons, loss of soil tilth due to mechanical mixing and compaction, and potential losses in available plant nutrients would severely reduce or even eliminate soil/vegetation productivity. Soil biota which also contribute to soil fertility may also be expected to decrease.

The increase in soil loss from surface-disturbing activities would potentially reduce the useful life of dams and other water retention structures that receive the additional sediment load. The quality of surface waters may also be degraded by sediment and associated dissolved salts.

Estimated erosion and sediment yield on the entire PRLA Area are shown in Table 3-2. Indications are that the allowable annual soil loss tolerance (as defined by the USDA, Soil Conservation Service) is already being exceeded on Soil Associations No. 1, 2, 3, and 10. Surface disturbance as a result of mining activities would accelerate present soil losses, and potentially cause

TABLE 3-2
POTENTIAL ANNUAL SEDIMENT YIELD ON THE PRLA AREA

Soil Association	Acres	Yield Rate Acre Feet/ Square Mile/Yr ^{a/}	Range of Total Yield Acre Feet ^{b/}	Range of Total Yield Tons ^{b/}	Total Yield Tons/Acre/Yr ^{b/}
1	1,600	0.5-1.0	1.25-2.50	2,314-4,628	1.45-2.89
2	24,600	>3.0	>115.32	>213,457	>8.68
3	29,830	1.0-3.0	46.61-139.83	86,275-258,825	2.89-8.68
4	7,820	0.2-0.5	2.44-6.11	4,516-11,310	0.58-1.45
5	4,870	0.2-0.5	1.52-3.81	2,814-7,052	0.58-1.45
8	640	0.0-0.2	0-0.20	0-370	0.00-0.58
9	2,560	0.2-0.5	0.8-2.00	1,481-3,702	0.58-1.45
10	<u>3,580</u>	1.0-3.0	<u>5.59-16.77</u>	<u>10,347-31,041</u>	2.89-8.67
TOTALS	75,500		57.67-286.54	107,747-530,385	

Notes: ^{a/} State of New Mexico, Natural Resources Department, and USDA, Soil Conservation Service 1979.
^{b/} Decimal placing is for calculation purposes only; it is not meant to imply degree of accuracy.

soil loss tolerances to be exceeded on the other soil associations. Potential impacts would therefore become more important in terms of the loss of soil/vegetation productivity, sedimentation, and surface water quality degradation.

Table 3-3 gives the magnitude of sediment yield (soil loss) on only the areas proposed to be strip mined. These areas currently contribute nearly 30 percent of the total sediment yield in the PRLA Area considered in Table 3-2. Surface disturbance would increase this percentage, and the negative impact would be correspondingly greater.

Overburden materials containing toxic quantities of certain trace elements such as boron may be exposed during strip mining. These materials would have a negative impact on potential vegetative production and reclamation, and may adversely impact surface water quality.

Mitigation measures and general reclamation procedures would reduce the magnitude and long-term importance of many of these impacts.

Relationship Between Short-Term Use and Long-Term Productivity

Long-term soil productivity and vegetation production would be lost on the major portion of the 705 acres used for surface facilities. During the period of strip mining operations (short term), soil and vegetation productivity would be greatly reduced or eliminated on the strip mined lands (approximately 22,020 acres). However, not all these lands would be removed from production at one time, thereby reducing the short-term impact from productivity loss.

Implementation of revegetation/reclamation procedures at the earliest possible time after mining a portion of land would initiate the process of restoring lost productivity. Successful reclamation (i.e., the rebuilding of soil characteristics suitable for plant growth) would allow potential productivity to approximate that which existed prior to strip mining. In some areas such as badlands, productivity may potentially be greater after successful reclamation than it is at present.

Irreversible and Irretrievable Commitments of Resources

The loss of soil, plant nutrients, biota, and vegetation production as a result of strip mining processes would be an irretrievable commitment of resources. The effects of such losses, however, would exist only in the short term if reclamation was successful. Land utilized for surface facilities would undergo an irreversible loss of resource and resource productivity.

WATER RESOURCES

Impacts

Surface Water

Surface mining in the PRLA Area would destroy many of the natural channels that presently drain the strippable coal area. Runoff originating upstream of mining activity would usually be diverted around the disturbed areas. Runoff originating in the disturbed areas would be controlled with berms

TABLE 3-3

POTENTIAL ANNUAL SEDIMENT YIELD ON AREAS TO BE DISTURBED BY SURFACE MINING AND FACILITY STRUCTURES

Location	Soil Association	Acres	Yield Rate Acre Feet/ Square Mile/Yr ^a / _a	Total Yield Acre Feet/ Acre Feet ^b / _b	Total Yield Tons ^b / _b	Total Yield Tons/Acre/Yr ^b / _b
T. 19 N., R. 5 W.	10	1,700	1.0-3.0	2.66-7.98	4,924-14,771	2.90-8.69
T. 20 N., Rs. 7 and 8 W.	10 9	1,516 1,104	1.0-3.0 0.2-0.5	2.37-7.11 0.34-0.86	4,387-13,161 629-1,592	2.89-8.68 0.57-1.44
T. 21 N., R. 8 W.	3 4	1,088 892	1.0-3.0 0.2-0.5	1.70-5.10 0.28-0.70	3,147-9,440 518-1,296	2.89-8.68 0.58-1.45
T. 22 N., R. 10 W.	3 2 4	1,247 2,246 1,497	1.0-3.0 >3.0 0.2-0.5	1.95-5.85 >10.53 0.47-1.17	3,609-10,828 >19,491 870-2,166	2.89-8.68 >8.68 0.58-1.45
T. 23 N., R. 12 W.	4,5 3 2	6,400 3,731 539	0.2-0.5 1.0-3.0 >3.0	2.00-5.00 5.83-17.49 >2.52	3,702-9,255 10,791-32,374 >4,665	0.58-1.44 2.89-8.68 >8.65
T. 24 N., R. 12 W.	2	60	>3.0	>0.27	>500	>8.33
TOTALS		22,020		17.60-64.58	32,577-119,539	

Notes: ^a/ State of New Mexico, Natural Resources Department, and USDA, Soil Conservation Service 1979.
^b/ Decimal placing is for calculation purposes only; it is not meant to imply degree of accuracy.

to prevent drainage to undisturbed areas downstream. This water would be lost to evaporation and infiltration; however the quantity should be small. Thus recharge to the alluvium downstream of mined areas should not be greatly affected. (Rules and regulations governing control of surface runoff during and after mining operations are contained in Sections 20-41 through 20-49 of the New Mexico Surface Coal Mining Regulations.)

Following mining operations, the disturbed areas would be regraded and new channels will be located to approximate the pre-mining drainage pattern. The quality of runoff from disturbed areas would be monitored until it is acceptable to the Mining and Minerals Division of the New Mexico Department of Energy and Minerals.

Runoff from disturbed areas following reclamation would vary, depending on the treatment each area receives. The regraded spoils would be more porous and have higher infiltration rates than the existing badland areas. As the regraded spoils begin to weather, the spoil surface would seal up, reducing infiltration and increasing runoff. This would approximate the existing badland conditions. Where the regraded spoils are covered with a sandy planting medium and a new vegetative cover is established, infiltration should remain higher and runoff should be lower than the existing badland situation.

Ground Water

Surface mining of strippable coal deposits would disrupt several aquifers in the PRLA Area. As mining proceeds through alluvial channels, local sources of shallow ground water would be destroyed. Successful reclamation of mined areas may mean less runoff to alluvial channels downstream, with less recharge to the ground water in the alluvium. This would be a very local effect, and would be confined to the area between the PRLAs and the alluvium of Chaco Wash.

Mining would destroy the stratified nature of the Kirtland-Fruitland overburden as well as the coal seam itself. These formations, including the coal, are not high-yield aquifers, but they do provide water to many wells in the area. The present, stratified overburden would be replaced by a single, somewhat homogeneous zone of ground water overlying the Pictured Cliffs Sandstone. The regraded mine spoils would have a porosity about 30 percent greater than the present overburden (USDI, BLM 1981).

The Pictured Cliffs Sandstone, a very tight sandstone with poor water quality, underlies the Fruitland coal-bearing zone and would also be affected by mining operations. The sandstone would not be completely destroyed, but well yields would likely be affected. Mixing of ground water from the replaced and regraded spoils with ground water from the Pictured Cliffs Sandstone would also occur.

Deep aquifers in the PRLA Area would not be affected by stripping operations. However, the withdrawal of large quantities of water from deep aquifers for coal processing and reclamation would represent the most important hydrologic impact associated with the Proposed Action. Water uses associated with development of the PRLAs are discussed below.

Water Use

The only known use of surface water in the PRLA Area is livestock and wildlife watering from stock ponds constructed on ephemeral channels. Some stock ponds would be destroyed during mining activities; however, livestock water would not be needed in areas being mined. Temporary impoundments constructed for mining activities may be converted to stock ponds following mining, or new ponds may be constructed as part of the mine reclamation plan.

At least one mining company has expressed interest in storing all possible surface runoff for use in mining and reclamation. This company anticipates using ground water to augment the surface water supply because runoff may be insufficient to meet projected needs. The appropriation of surface water would require a permit from the State Engineer.

Numerous wells have been drilled in the PRLA Area to develop the ground water resource for livestock and domestic use (refer to Map 2-4). Most of these wells are completed in the Kirtland and Fruitland Formations, the Pictured Cliffs Sandstone, the Menefee Formation, the Cliff House Sandstone, and the channel alluvium. All of the wells that occur in areas to be mined would be destroyed, regardless of the formation which produces the water. In addition, the Kirtland and Fruitland Formations, and in some places the channel alluvium, would be destroyed as aquifers in the strippable coal area. Off-site impacts would include changes in well yields, water levels, and water quality in the Pictured Cliffs Sandstone, the Kirtland and Fruitland Formations, and the channel alluvium downstream to Chaco Wash. Section 9-21 (a) (3) of the New Mexico Surface Coal Mining Regulations requires mine reclamation plans to ensure the protection of existing water uses or provide alternate sources of water where existing uses cannot be protected.

Mining companies have identified the need for 12,850 acre-feet of water per year for mining operations, dust suppression, coal washing, and reclamation in the PRLA Area. Surface water and shallow aquifers do not produce this volume of water; thus, other sources of water would have to be developed.

The New Mexico State Engineer's Office is currently considering several applications to appropriate San Juan Basin ground water for use in the PRLA Area. All but one of these applications identifies the Westwater Canyon Member of the Morrison Formation and/or the Entrada Sandstone as the desired source of supply (Charles Wohlenberg, NMSEO, pers. comm.). These formations are over 4,000 feet deep in the PRLA Area. The remaining ground water application identifies the Ojo Alamo Sandstone and the Nacimiento Formation as the desired source of supply. These formations occur north and east of the PRLAs.

Each proposed ground water withdrawal would create a local drawdown in the water level in the producing aquifer. Ground water flow in these aquifers may be altered in the vicinity of the withdrawal. The New Mexico State Engineer's Office carefully analyzes the effects of each withdrawal on the water levels in the aquifer before issuing a permit to appropriate the ground water. The State Engineer requires that existing wells be protected or the water supplies replaced by the applicant if issuance of a new permit will cause impairment of an existing water use. New Mexico Surface Coal Mining Regulations (Section 20-54) require that each mining operation comply with any water replacement plan approved by the State Engineer and all other applicable regulations administered by the State Engineer.

Water Quality

The quality of surface water entering the strippable coal area should not be affected by mining operations. Runoff from above the mines would be diverted around disturbed areas, and runoff from within the disturbed areas would be passed through sediment ponds before being released to downstream arroyos. Structures for diverting upstream runoff around the mined areas must conform to Section 20-43 of the New Mexico Surface Coal Mining Regulations to prevent additional contributions of suspended solids to runoff and streamflow. Sediment control measures, including sediment ponds, must conform to Sections 20-45 and 20-46 of the mining regulations so that effluent limitations set forth in Section 20-42 will be met. Through proper design of sediment control facilities, runoff from within the mine area should be discharged with less suspended sediment than runoff outside the mine area.

After an area has been mined and the spoils replaced and regraded, new channels would be established to drain the mined area. These channels would be a source of suspended sediment until the beds and banks become stabilized. Also, surface runoff flowing over newly-regraded spoils may pick up more dissolved solids than runoff in undisturbed areas. In either case, the state mining regulations (Section 20-42) require that sediment ponds and treatment facilities be maintained until erosion has been controlled and the untreated runoff meets applicable state and federal water quality standards.

Mining operations should encounter very little ground water in the PRLA Area. Neither the overburden nor the coal seam are good water-bearing units.

While the amount of water seeping into the mines should not be a problem, the quality of the water would be a problem. Water quality reported for the coal seam and the overburden is poor, with high concentrations of dissolved solids. Water quality in the channel alluvium below the mines is much better, with dissolved solids concentrations in the range 500 to 1,500 milligrams per liter (mg/l).

Part 3 of the New Mexico Water Quality Control Commission Regulations establishes standards for discharges onto or below the ground surface. These standards are designed to protect ground waters, such as the channel alluvium, with dissolved solids concentrations less than 10,000 mg/l. Because the ground water that would seep into the mine does not meet the New Mexico Water Quality Control Commission standards, it could not be discharged to alluvial channels below the mine without treatment. The use of sediment ponds may not be adequate for meeting water quality standards, because dissolved solids would not settle out. Mining operations that discharge mine water may only do so under an approved mining plan and a permit issued by the New Mexico Coal Surface Mining Commission, which administers the water quality standards for coal mining.

Following mining, the replaced and regraded spoils would form a single zone for ground water above the Pictured Cliffs Sandstone. The quality of water in this zone would be similar to that in the existing overburden and coal seam, except it may be more mineralized because of the greater porosity. The water quality in this zone may be poor even for livestock water. Thus, replacement water would have to come from converted reclamation wells or new wells drilled to the Cliff House Sandstone.

Water quality impacts would also occur as a result of using deep aquifers as a source of reclamation water. Available information indicates that the quality of water for irrigation is unsuitable in the Entrada Sandstone and marginal in the Westwater Canyon Member of the Morrison Formation. Both formations yield water high in sulfates, total dissolved solids, and sodium adsorption ratio, with water in the Entrada Sandstone being well above recommended criteria for irrigation supplies. Revegetation of the PRLAs would be difficult because of the saline nature of the overburden material. The irrigation schedule for revegetation efforts would likely be limited to 2 years or less; nevertheless, the use of saline water, such as that produced by the Entrada Sandstone, may require treatment to avoid a buildup of salts in the planting media. Also, discharge of water from deep aquifers to alluvial channels would require treatment to meet water quality standards for discharges onto or beneath the surface.

Relationship Between Short-Term Use and Long-Term Productivity

The existing use of surface water and shallow ground water for livestock and occasional domestic supply represents the only foreseeable use of this limited, poor-quality resource. Off-site impacts on these uses should be minimal. Water supplies for livestock on the disturbed areas would be replaced as part of the mine reclamation plan. These supplies would probably be developed from new wells drilled to the Cliff House Sandstone or by conversion of water systems used for reclamation.

The development of deep wells for short-term use for mining operations would enhance the long-term productivity of the water resource by providing a more reliable supply for the area. Untreated water quality would render this water suitable only for mining and industrial uses, livestock watering, and, in limited situations, irrigation. If treated, the water would be suitable for irrigation and human consumption. The appropriation of water for these uses is governed by rules and regulations administered by the New Mexico State Engineer's Office.

Irreversible and Irretrievable Commitments of Resources

Mining operations would destroy the stratified nature of the Kirtland-Fruitland overburden and coal seam. While these formations are not good aquifers, they do supply several wells in the area. This represents an irreversible and irretrievable commitment of resources; however, the effect of this commitment would be mitigated through development of replacement water supplies.

Mining companies have identified the need for 12,850 acre-feet of water per year for mining operations and reclamation. If permits to appropriate this water are granted by the State Engineer, this use can be considered an irreversible and irretrievable commitment of the water resource. Recharge to the aquifers is slow; thus, the withdrawal of water from these units can be considered a permanent loss of supply.

Although the withdrawal of 12,850 acre-feet of water per year is an irreversible and irretrievable commitment, the decline in water levels in the producing aquifers is reversible to a large extent. The Entrada Sandstone and Morrison Formation are under extreme artesian pressure, and water levels for these formations would rebound substantially when the large-scale withdrawals cease.

Recommended Mitigation

Water supplies used for reclamation of mined areas should meet the following quality criteria:

Total Dissolved Solids < 6,000 mg/l;
Sulfate, Dissolved < 3,000 mg/l;
Sodium Absorption Ratio < 30.

Water supplies not meeting these criteria would require treatment to these levels before being applied to revegetated areas.

WILDLIFE

Impacts

Mining activities and related developments, including increased human activities, would alter wildlife species diversity, density, and habitat on both the PRLA Area and adjacent regions. The magnitude of impacts from mining (surface or subsurface) would vary with the extent and type of activity involved and the type of habitat disturbed. Such developments as oil and gas facilities, generating stations and housing areas may be sited in locations near the PRLA Area would have impacts on wildlife species similar to those described for mining. Specific impacts from both types of mining are discussed below under three categories: wildlife species, habitats, and threatened and endangered species.

Surface Mining

Impacts on Wildlife. Impacts on wildlife from exploration, extension of existing roads, and construction of new roads and support facilities would be minor. The impacts would vary by species because of their differing tolerances for human activity. Deer, antelope and numerous bird species would shift to other areas where human disturbances were less or absent. The distances moved by these species would depend on their tolerances for human activity, their mobility, and the amount of competition from wildlife already present in these areas. Some mortality would occur to the more mobile species from vehicular traffic associated with exploration and construction, but the most would occur to small mammals, reptiles, amphibians, and invertebrates. Fencing around mine sites and along some rights-of-way would impede feeding and migratory movements of larger species, especially deer and antelope.

The actual mining, with attendant stockpiling of overburden, topsoil and coal, would have the most serious impacts of all operations. Impacts on local native wildlife populations, especially the less mobile species, would be major. Destruction of vegetation used by wildlife as food and shelter would be widespread until measures of reclamation began to manifest themselves. Deer, antelope and several other mammal species, along with most birds, would relocate to other areas having lower levels of human activities. Other wildlife, especially small mammals, reptiles, amphibians and invertebrates would probably be lost because of their relative immobility or limited activity ranges.

Species with small populations, especially deer and antelope, could be significantly reduced by surface mining through destruction of habitat and associated human pressures. It is possible that these populations could be destroyed entirely unless mitigation measures and transplants are employed to reverse the trend.

Although numerous small animal forms would be lost on each acre disturbed by surface mining, the regional impacts would be relatively low.

Secondary consumer species (carnivorous predators and raptors) would also be affected by a loss of prey species (herbivores). Impacts on predators and raptors would be less noticeable because of their mobility and ability to find new feeding grounds.

Displaced wildlife would tend to migrate into unfamiliar and often unsuitable habitats that are already sustaining maximum wildlife populations. The net cumulative impact would be inter- and intraspecific competition for available resources (food, cover and space), resulting in wildlife population intolerances and eventual mortalities. Disturbances associated with mining noise, vibrations, and increased vehicular traffic could alter feeding and movement patterns for various terrestrial fauna, especially deer and antelope. Some mortality would occur on roads through areas of increased populations.

Reclamation following mining operations would have beneficial effects upon wildlife. The development of new vegetative communities would attract wildlife, although the faunal composition would differ both qualitatively and quantitatively from the original populations. Faunal changes would occur with time as the vegetative composition developed toward a climax condition.

After the completion of mining, some or all of the facilities would be removed, depending on the wishes of the landowner. Some equipment would be moved to mine coal in other regions, and the resultant disturbance would force some wildlife species into other areas. Continued use of roads by vehicular traffic would still cause mortality among some species of wildlife and keep others away. Fencing that is left in place would continue to impede daily activities and passage of deer, antelope and other large forms of mammals, especially into newly reclaimed areas.

Impacts on Habitat. An analysis of the various vegetative types appears in the vegetation section. For the purpose of discussion in this wildlife section, there are four basic wildlife habitat types in the PRLA Area: aquatic, riparian, pinyon-juniper woodlands and grassland-desert shrub-saltbush. At this time, it is estimated that about 23,000 acres of land would be destroyed by surface mining.

Grassland-desert shrub-saltbush is the most abundant and widespread habitat type, accounting for nearly 99 percent of the PRLA Area. Many mammals (especially rodents adapted to dry land), birds, reptiles, amphibians and invertebrates that are less mobile and occupy a limited home range would experience a loss of habitat, including escape cover, dens and nesting sites, and food availability.

Both the pinyon-juniper woodlands and the riparian habitats represent slightly over one percent of the PRLA Area. Both habitats are known to support a diverse and abundant wildlife fauna. However, these habitats are scattered, in many places poorly developed, and usually overgrazed by livestock. These conditions contribute to low populations of wildlife forms that typically use these areas for foraging and shelter. Except for a few species, especially some passerine songbirds, the loss of these habitats through surface mining would be of little consequence to the faunal composition of the overall area. Most displaced species would occupy similar habitats in adjacent areas.

There are no permanent natural aquatic habitats in the PRLA Area. Any aquatic habitat that may develop as a result of the Proposed Action, such as settling ponds, would be of limited area and short duration. The value of aquatic areas would also depend on water quality.

Impacts on Threatened and Endangered Species. There are three species of endangered wildlife that are known to occupy or potentially occupy (for short periods), sections of the PRLA Area. The black-footed ferret, sighted in sections of McKinley County (Table 2-7, Map 2-6) may be found in the PRLA Area because its chief food, the prairie dog, has numerous towns in and around the area. The ferret also uses the prairie dog's burrows for shelter. The destruction of these burrows by surface mining would result in the loss of habitat potentially used by the ferret.

Increased human activity resulting from surface mining could inhibit any habitat and feeding utilization of the area by peregrine falcons and bald eagles and could result in illegal shootings. The loss of habitat would also be detrimental to the breeding and feeding of any prey species utilized by falcons. This loss would be similarly felt by such threatened species as the Mississippi kite, red-headed woodpecker, Baird's sparrow and McCown's longspur.

Underground Mining

Impacts on Wildlife. Exploratory activities would have slight impacts on native species. Construction of access and service roads and ventilation shafts would have extensive impacts on many wildlife species. Cumulative impacts from various mining activities, especially the construction of support structures and stockpiling, would alter wildlife diversity, density and habitat utilization in the PRLA Area and adjacent regions. The magnitude of impacts from underground mining operations would be quite variable, but unlike surface mining, would probably decrease with age of the mine.

Some mammals (mainly rodents), reptiles, amphibians, and numerous invertebrates would be destroyed by direct impacts associated with mining activities. These impacts would be localized and limited. Secondary consumers (carnivorous predators) would be affected by a loss of these prey species. Displaced predators would tend to migrate into other habitats or areas which may already be at capacity for sustaining wildlife.

Abandonment of mining would have beneficial effects on wildlife populations. Development of new vegetative communities would draw wildlife although the faunal composition following reclamation would not be the same either qualitatively or quantitatively as in the original habitat.

Impacts on Habitat. The destruction of vegetation used by wildlife for breeding, feeding and nursery grounds would result from underground mining. Loss would be centered around mine shafts, roads, stockpile areas and other support structures, with most damage occurring during initial construction. The loss would be in the form of reduced escape cover, dens, nesting sites and available food sources for many wildlife species. In addition, inter- and intraspecific competition would result from habitat displacement of various species on lands adjacent to mine sites. The quality of aquatic habitats formed from settling ponds and land subsidence would depend on the longevity and quality of the water source.

Impacts On Threatened and Endangered Species. While the potential exists, it is unlikely that the black-footed ferret would be impacted by underground mining. The probability of its occurrence would be further reduced by the destruction of prairie dog towns, which serve as a source of food and shelter. Increased human activity would also inhibit any habitat and feeding ground utilization by bald eagles and peregrine falcons and could potentially result in illegal shootings.

Relationship Between Short-Term Use and Long-Term Productivity

Surface Mining

Not only would actual mining operations exclude the PRLA Area and some adjacent regions from use by wildlife, but numerous species would be excluded from these areas following reclamation over a 5-year period, and possibly longer. After reclamation, the area may not be entirely rehabilitated. Wildlife found in the area before mining operations may not use the area again because of changes in the land or vegetation. Should endangered species be encountered and adversely affected during the life of the projects, their long-term productivity could be greatly impaired in the proposed PRLA Area.

Underground Mining

Mining operations and associated activities would limit the area that could be used by certain species of wildlife for the life of the project and possibly longer. The land may not be entirely rehabilitated after abandonment. Wildlife found in the PRLA Area before mining may not return. Should endangered species be encountered and adversely impacted during the life of the project, their long-term productivity could be greatly impaired.

Irreversible and Irretrievable Commitments of Resources

Surface Mining

The loss of any endangered species would represent an irreversible and irretrievable commitment. Any wildlife production that is prevented during periods of mining would be irretrievably lost.

Underground Mining

Any loss of endangered species would be an irreversible and irretrievable commitment. Any wildlife production prevented by this type of mining would be irretrievably lost.

LIVESTOCK GRAZING

Impacts

An estimated total of 2,032 AUMs would be lost as a result of the Proposed Action's surface-disturbing activities. Ten of the twelve allotments in the PRLA Area would lose AUMs in varying degrees. (Refer to Table 3-4 for acres and AUMs disturbed by allotment and PRLA number. Also refer to Appendix C-2 for vegetative acre and AUM disturbance by allotment and PRLA number.) AUMs that would be recovered as a result of reclamation efforts is unknown and unpredictable at this time.

TABLE 3-4

ACRES DISTURBED AND AUMs LOST ON THE PRLA AREA

Allotment Number Name		PRLA Number	Acres Disturbed	AUMs Lost	Allotment Number Name		PRLA Number	Acres Disturbed	AUMs Lost
6008	Bisti Community	NM-11916	125 ^a / ₇	7	6013	Kimбето Community (Cont'd) No. 6 (Cont'd)	NM-8745 NM-9764 Subtotals	60 190 <u>2,380</u>	6 18 <u>184</u>
6009	El Smith	NM-6802	340	23		Totals		<u>4,100</u>	<u>354</u>
6010	Black Lake (Paragon Resources)	NM-3919 NM-3755 NM-3837 NM-3836 NM-3835 NM-3838 NM-3752 NM-3753 Totals	350 580 1,780 ^b / ₁₉₈ 1,920 3,380 ^b / ₁₉₁ 60 100 1,180 9,350	19 51 198 191 344 6 13 75 897	6015	Counselor Community	8715	150	13
6011	Otis Community	No acreage disturbance			6016	Lake Valley Community	No acreage disturbance		
6012	Tsaya (AMP)	NM-3752 NM-3754 Totals	1,520 740 ^c / ₁₂₇ 2,260	85 42 <u>127</u>	6017	Chaco Canyon	NM-8128 NM-11670 Totals	50 80 <u>130</u>	2 7 <u>9</u>
6013	Kimбето Community No. 1 No. 3 No. 4 No. 5 No. 6	No acreage disturbance No acreage disturbance NM-3918 NM-3919 Subtotals NM-3918 NM-3755 Subtotals NM-3918 NM-3919	900 400 1,300 60 ^c / ₆ 360 420 980 1,150	96 47 143 6 21 27 98 62	6018	Pueblo Pintado Community	NM-8130 NM-8128 Totals	1,580 1,875 ^c / ₄₀₂ 3,455	174 228 <u>402</u>
					6019	M. Tanner Chaco Energy Company	NM-8715	410	38
					6023	Star Lake Community	NM-8717 NM-585 Totals	480 1,825 ^c / ₁₂₂ 2,305	40 122 <u>162</u>
					NIIP	No acreage disturbance			
						GRAND TOTALS		22,625	2,032

Source: Applicants' initial showing information 1980.

Notes: ^a/ Acres disturbed for underground support facilities.
^b/ Total includes acreage and AUMs for underground support facilities.
^c/ Total includes acreage and AUMs for surface mine support facilities.

Existing range developments that would be removed by mining would include 20.5 miles of fence, three cattleguards, ten dirt reservoirs, two corrals, two wells and two windmills. Other impacts expected as a result of mining include livestock distribution restrictions, livestock harassment, livestock road mortalities, and disruption of one allotment management plan (AMP) grazing system. Additional AUM, range development, and livestock damage or loss may occur as a result of subsidence on the areas mined by underground methods.

Relationship Between Short-Term Use and Long-Term Productivity

In the short term there would be a loss of approximately 2,032 AUMs (combined total) on the PRLA Area. Loss of these AUMs would occur over several years and should eventually be returned to full or near-full production in the long term. Surface disturbance and reclamation timeframes, or sequence, are presently unknown; therefore, estimates as to when acres and AUMs would be returned to production is unpredictable.

Irreversible and Irretrievable Commitments of Resources

Annual loss of AUM production would also occur in the areas to be strip mined. More specific determinations of these AUM losses would depend on the amounts of acreage disturbed and time periods required for reclamation. This data is not available at the present time. The grazing schedule on one AMP would also be changed or altered by disruption of the pasture rotation system.

RECREATION

Impacts

Should all applicants meet final showing and coal development occur, 50,188 acres of accessible public land would be removed from public use. Public use on these tracts for participation in dispersed recreational hunting, collecting, sightseeing, off-road vehicle use, and back-country use can be characterized as relatively low-density use. However, those users would have to seek their recreation elsewhere.

Additional dispersed recreation demand from natural population growth, proposed coal leasing population growth, and displaced recreationists would impact recreation, generally in terms of diminishing the quality of the recreation experience.

The increased traffic flow and rerouting of State Highway 57 could interrupt visitation to the Chaco Culture National Historical Park. The viewing of active mining along State Highway 57 would provide the opportunity to provide an interpretation program to those driving to and from the park.

Mining operations (as proposed in the initial showing of the various applications) indicate mining or surface disturbance from mining would occur within the boundaries of the three proposed ACECs of the recreation program. The ACEC process (as identified in the Federal Land Policy and Management Act) would be used to provide whatever special management is required to protect those environmental resources qualifying the area as a potential ACEC. Because these ACECs coincide with the three Wilderness Study Areas (WSAs), no direct

impact would be anticipated to occur on them. WSAs are considered unsuitable for mining while under review based on Unsuitability Criterion Number 4 of 43 CFR 3461 (d)(1).

The Continental Divide Trail, another proposal of the BLM's recreation program, would not be directly impacted by coal mining activities on the PRLAs. Visitor use of the trail would, however, be indirectly impacted by access roads, rail spurs, utilities, noise, and dust as a result of leasing. Some of these activities would intermittently impede use of the trail and diminish the quality of the recreation experience for those visitors hiking the trail through the PRLA Area.

Relationship Between Short-Term Use and Long-Term Productivity

The major impacts on dispersed recreation would be the removal of lands from use during the mining and reclamation operation, and the anticipated demand for recreation activities as a result of population growth. During the period of mining and development, (20 to 40 years) the area's remote and open space character would diminish, which would discourage the use of the area for recreational purposes. The success of reclamation, the recovery of wildlife, and ease of access would determine the ultimate long-term recreation use of the disturbed areas.

Irreversible and Irretrievable Commitments of Resources

Any loss in the quality of a satisfactory recreation experience as a result of increased encounters with other recreationists or displacement of recreationists during mining of the PRLAs would be an irreversible commitment.

Recommended Mitigation

During revegetation, it is recommended that seed mixtures be used that will encourage the recovery of wildlife species in order to benefit wildlife-related recreation pursuits.

WILDERNESS

Impacts

Section 603(c) of the Federal Land Policy and Management Act (FLPMA) (P.L. 94-579, 90 Stat. 9743) directs the BLM to manage lands under wilderness review in this way:

During the period of review of such areas and until Congress has determined otherwise, the Secretary shall continue to manage such lands according to his authority under this Act and other applicable law in a manner so as not to impair the suitability of such areas for preservation as wilderness . . .

This section also provides a special exception, from the nonimpairment mandate for existing mining and mineral leasing uses "grandfathered uses." A grandfathered use is one that was taking place on the lands as of the date of approval of FLPMA (October 21, 1976), and it must have created actual physical impacts before that date.

As stated in the Interim Management Policy and Guidelines for Lands Under Wilderness Review (USDI, BLM 1979a):

The preference right lease applicant's right to adjudication of his right to a lease will be recognized. Application of the right, however, involves application of the coal unsuitability criteria, including the wilderness review criterion number 4, of 43 CFR 3461(d)(1) and the imposition of conditions in the proposed lease to prevent impairment of the area's suitability for preservation as wilderness.

The Secretary may initiate exchange proceedings for coal under 43 CFR 3430.5-4 if he determines that, among other things, the lands are unsuitable for coal mining because of wilderness considerations.

If activities conducted in connection with a surface mine or operations, or surface impacts incident to an underground mine as defined in Section 701 (28) of the Surface Mining Control and Reclamation Act (30 USC 1291 (28)) should occur, impairment of the area's suitability for preservation as wilderness would occur in violation of P.L. 94-579 and 43 CFR 3461(d)(1).

Seven lease applications on which WSAs overlap are listed in Table 3-5. The overlaps range from 1 percent (42.76 acres) on PRLA NM-6801 to 95 percent (4,591.28 acres) on PRLA NM-3834. On PRLA NM-3834, NM-3838, NM-3918, NM-3919, NM-6801, NM-6804, and NM-11916, a total of 13,424.21 acres (and an undetermined amount of coal) would be removed from mining in compliance with the unsuitability criteria so as not to impair the areas' suitability for wilderness designation.

TABLE 3-5			
PRLA AND WSA ACREAGE CONFLICTS			
PRLA Number	PRLA Acreage	WSA Acreage Overlap	Percent of PRLA
NM-3834	4,804	4,591.28 ^{a/}	95
NM-3838	4,787	3,114.77 ^{a/}	65
NM-3918	4,477	985.04 ^{b/}	22
NM-3919	4,478	3,156.24 ^{b/}	70
NM-6801	4,394	42.76 ^{a/}	1
NM-6804	1,602	1,214.12 ^{b/}	76
NM-11916	2,880	320.00 ^{c/}	11
TOTALS	27,422	13,424.21	

Notes: ^{a/} WSA NM-010-004
^{b/} WSA NM-010-057
^{c/} WSA NM-010-009

Increase in noise levels above existing ambient levels is expected to occur in the PRLA Area as a result of mining and transportation activities. The amount or length of time any one person would experience these levels of noise within adjacent WSAs would depend on the distance, source, and type of activity. The degree of impact is unknown, but it could be presumed that the noise would be a distraction to the solitude values associated with a wilderness.

The Proposed Action, through the disturbance of soil and removal of vegetation, would increase particulate matter from fugitive dust emissions in the vicinity of the mine operations, mine facilities, and transportation routes. These fugitive dust emissions would have an unknown impact on the WSAs and their users.

Coal mining and usage in the region is also expected to generate an increase in the local population. With this increase in population, it is presumed that use of WSAs for recreational purposes would increase. With the increase in use, the potential for increased littering, vandalism of scientific and educational values, and off-road vehicle intrusions is expected to occur in an unpredictable amount.

The environmental impact statement (EIS) covering the three WSAs is scheduled to be completed by mid-1983. All recommendations made as a result of the EIS and study will be forwarded to the President and then to Congress, as only Congress can make the final wilderness decision. Until such a final decision is made, all WSAs are considered unsuitable for mining. If Congress determines that a WSA will not be designated as wilderness, the unsuitability criteria and the Interim Management Policy will no longer apply. If Congress designates a WSA as wilderness, the BLM will manage the area for preservation of its wilderness character. FLPMA requires that designated wilderness areas be managed under provisions of the Wilderness Act of 1964 (Public Law 88-577, 78 Stat. 890, 16 USC 1131).

Irreversible and Irretrievable Commitments of Resources

An undetermined amount of federal coal reserves under 13,424.21 acres would be irreversibly committed should these WSAs be designated as wilderness and managed under the provisions of the Wilderness Act of 1964.

CULTURAL RESOURCES

Impacts

Archeological Sites

The Proposed Action would result in increased scientific knowledge about past cultures in the PRLA Area. This knowledge would come from cultural resource inventories, the Chacoan roads project, and any site excavations that were carried out prior to mining. The value of the information retrieved from these mitigation measures would be directly related to the quality of available professional expertise.

Typically, cultural resource inventories must be performed under very tight timeframes because of the large amounts of capital and labor involved in energy development. These conditions rarely allow for the analysis of site data at the time it is collected. Money for analysis often is not available at a

later time, and much of the potential value of the site data is lost. If analysis does occur, it may not be possible to resolve any new research questions that arise from the analysis because it is probable that few sites are intact. Based on presently available information, it is unlikely that the integrity of any site on the PRLA Area can be maintained under the Proposed Action without continual on-site monitoring.

All sites in stripping areas would probably be destroyed. Sites left intact on pillars within mined areas would retain little scientific value.

Vibration from blasting, heavy mine equipment, haul trucks and trains would affect the stability of standing masonry walls and rock cairns. Sites could be destroyed by surface swells, tension cracks, and crumbling of the edges of mesas from subsidence of areas overlying deep mines. Judging from field observations of OSM archeologists (Killam, personal communication 1980), the occurrence of subsidence and its effects on archeological resources cannot be predicted.

Changes in present patterns of natural erosion could also affect sites. Alteration of present drainage channels could accelerate water erosion of some sites. Wind-borne soils from disturbed areas would be deposited in new locations, possibly burying previously visible sites in downwind areas.

The number of construction workers and permanent employees at the mines would be another source of potential damage to cultural resources. According to traditional Navajo belief, artifacts from the past should be left undisturbed. However, non-Navajos employed in the mines may not share Navajo beliefs regarding the handling of artifacts. Others with little knowledge or interest in past cultures could contribute to the destruction of sites without being aware of their existence. Direct site vandalism would be another probable occurrence. Direct or indirect damage from use of off-road vehicles would also probably occur. If permanent housing was constructed near the PRLA Area, site damage would be accelerated both by the increase in resident population and by the number of leisure hours the residents spent in the area.

Gravesites

Gravesites in stripping areas would be disturbed if they are not identified before mining and mitigated by reburial elsewhere. In traditional Navajo beliefs, disturbance of graves is associated with the practice of witchcraft (Kluckhohn, 1944). Although few Navajos are willing to talk openly about witchcraft, this belief is known to be important to many Navajo today. Belief that witchcraft is occurring can have a profound effect upon Navajo health and behavior. No data are available at this time to assess this type of potential impact from the reburial or disturbance of graves in the PRLA Area.

Sacred Sites

American Indian sacred sites in the PRLA Area would be subjected to the same range of impacts that have been discussed above for archeological sites. In addition, the utilization of sacred sites for the performance of ceremonial activities would be affected. Noise, vibration and dust from mining could impact ceremonial activities that require quiet and solitude. The presence of non-Indians lacking knowledge of the ceremonies of another culture

could cause additional impacts, because the success of these ceremonial rituals, in the Navajo's beliefs, depends upon their correct performance. Data are not available to assess the extent of these impacts upon American Indians as a consequence of the Proposed Action.

Relationship Between Short-Term Use and Long-Term Productivity

The short-term commitment of the PRLA Area to energy production would probably eliminate the long-term scientific productivity of all in situ archeological resources except for any sites protected by continuous monitoring. If the scientific knowledge gained from the cultural resource mitigation measures required for mine development was applied to educational uses, the recreational value of any sites that remained could be enhanced for the visiting public.

The long-term productivity of sacred sites for the Indian people is unknown. No data are presently available to assess whether sacred sites that were protected during mining would hold the same sacred qualities for Indians after mining ceased. It is also unknown whether recontoured and revegetated areas could serve as ceremonial offering areas at some time in the future.

Navajo medicine men who have visited the McKinley Mine near Window Rock have commented that many of the plants in revegetated mine areas are foreign to the area. These individuals have stated that many of the native plants that are unpalatable to livestock have important ceremonial uses. It is not presently known whether traditional religious practitioners would use such plants from revegetated areas if these plants were incorporated into the revegetation plans of mining companies.

Irreversible and Irretrievable Commitments of Resources

Archeological sites are a non-renewable resource. All sites destroyed as a consequence of energy development would be irreversibly and irretrievably lost. For those sites mitigated by recordation or excavation, any information that could have been gained as a result of future improvements in scientific techniques would also be irreversibly and irretrievably lost.

The loss of some sites sacred to the Indian people would be irreversible and irretrievable. This would be true when the sacred quality of the site is based on the association between the site and the presence of supernatural beings in the past. Sites whose sacred quality derives primarily from ceremonial activities presently being performed may not be irreversibly and irretrievably lost as long as it is possible for these ceremonial activities to be performed at another suitable location.

Gathering areas for herbs, minerals or other items essential for the performance of a ceremony would be irreversibly and irretrievably lost if the area was the only location at which that item occurred. Destruction of a gathering area could also result in irreversible and irretrievable loss to a particular religious practitioner when the item, became too scarce, distant or expensive to obtain. Irreversible and irretrievable loss would also occur to those individuals for whose benefit the ceremony could have been performed, and by all others who would have attended the performance of that ceremony.

Recommended Mitigation

The Programmatic Memorandum of Agreement for the protection of cultural resources under the federal coal management program (refer to Appendix A-4) focuses on measures that protect the types of prehistoric and historic sites that are usually found on federal land. Special lease stipulations will be needed to cover the Chaco Road system, gravesites, and sacred sites of American Indians.

Chaco Roads

A protection program will be developed as an outcome of the ongoing BLM Chaco Roads Project. Lease stipulations for the mitigation of Chacoan roads on the PRLA Area would be based upon this protection program. Such stipulations could include in situ preservation of specific road segments, detailed recording of roads, and various types of data recovery.

Gravesites

1. The lessee will recognize the right of living descendants to make a decision on the disposition of any buried human remains of relatives on the lease area.
2. The lessee will sign a Memorandum of Agreement with the Navajo Nation on procedures for the reinterment of deceased Navajos on lands belonging to the Navajo Nation.
3. The lessee will follow the procedures set out in the New Mexico State Code for the disposition of unclaimed human remains.

Sacred Sites

The lessee will develop and carry out a plan to consult with American Indian religious practitioners to identify and develop mitigation measures for sacred sites on the lease area. The BLM recommends the following groups to participate in this consultation process:

1. Traditional Navajo religious practitioners living on or near the lease area.
2. Officials and other members of the Navajo Medicine Men's Association.
3. Tribally recognized Puebloan, Ute and Apachean religious practitioners with concerns about specific tribal sacred sites within the lease area.

PALEONTOLOGY

Impacts

Implementation of the Proposed Action would impact paleontological resources of the Late Cretaceous Fruitland and Kirtland Formations. Adverse impacts that could eventually result from the proposal to lease the PRLAs for coal mining include the destruction of 1,137 existing fossil-collecting sites (including sites on five PRLAs that are presently under long-term scientific study) and the removal of fossils from their contextual relationships. The construction of haul and access roads, new railways, and surface facilities at mine sites, and the removal of overburden would produce most of the adverse impacts. Table 3-6 shows the number of known fossil occurrences on the PRLAs that would require mitigation if the Proposed Action is implemented.

Developing coal mines on the PRLAs would produce a population increase in the San Juan Basin. This and the building of additional roads in the region would permit increased human access to fossil-collecting localities in and near the PRLAs. As a consequence, unauthorized collection and vandalism of fossils would increase.

TABLE 3-6

NUMBER OF FOSSIL OCCURRENCES REQUIRING MITIGATION

PRLA No.	No. of Occurrences	PRLA No.	No. of Occurrences
NM-585	0	NM-6802	3
NM-3752	74	NM-6803	8
NM-3753	69	NM-6804	19
NM-3754	17	NM-7235	0
NM-3755	1	NM-8128	12
NM-3834	21	NM-8129	14
NM-3855	26	NM-8130	3
NM-3836	0	NM-8715	1
NM-3837	0	NM-8717	0
NM-3838	23	NM-8745	0
NM-3918	0	NM-9764	0
NM-3919	160	NM-11670	0
NM-6801	37	NM-11916	10
		TOTAL	498

Paleontology may realize some benefit from implementation of the Proposed Action. During mining, subsurface paleontologic information that would otherwise be unavailable to the scientific community would become available. Such data would be important to a thorough understanding of the biota and paleoenvironment of the region during Fruitland/Kirtland times. However, reclamation would limit the time new exposures are available for continued

fossil yields and maintenance of reference sections for future studies. A comprehensive discussion of the potential extent of subsurface paleontological resources in the PRLA Area is presented in Chapter IV (pages 1-3), Star Lake-Bisti Regional Coal Final ES (USDI, BLM 1979b).

Relationship Between Short-Term Use and Long-Term Productivity

If the mining takes place, an increase in the availability of paleontologic data on the PRLA Area would occur. In the long term, however, the actual number of producing fossiliferous exposures would be reduced.

Irreversible and Irretrievable Commitments of Resources

A large portion of the 1,137 known collecting sites on the PRLAs would be destroyed if mining proceeds (refer to Table 2-15). Because reclamation of mined lands is required by law, any newly discovered sites on the PRLA Area would be lost. Along with these losses would go the loss of knowledge that might have been gained from both old and new sites in the future.

Recommended Mitigation

Should mining or construction reveal any new localities of importance, such activities could be delayed until salvage had occurred. Construction sites either directly or indirectly associated with mining could be relocated if it is determined that they are in areas where valuable collecting sites occur.

Several areas have been identified in the Chaco Planning update as having ACEC potential. If they are designated as Areas of Critical Environmental Concern, they should be considered for exclusion from surface coal mining. They include the Bisti Badlands, Hunter Wash, De-na-zin Wash, Alamo Wash, the "Fossil Forest", Bettonie Tsosie Wash, Kimbeto, Arroyo Torreon, and the Lybrook Badlands.

VISUAL RESOURCES

Impacts

If the final showing on all PRLAs, is made, the resulting coal development would create visual impacts from the mining and other associated activities, both on-site and off-site. As indicated in Chapter 1, coal would be recovered from the PRLAs by both surface and underground mining methods.

The on-site coal mining process generally consists of these phases: (1) exploration; (2) development; (3) production; (4) reclamation and (5) abandonment. In the exploration phase, visual impacts would be generally slight due to limited disturbance and development. The visual impact of the mining process would become more intense in the development and production phase due to the large amount of land and vegetation disturbance and the placement of facility structures on the leases. Reclamation efforts would usually proceed as contemporaneously as practicable behind the mining of coal. One of the goals of reclamation would be to reduce the visual contrast between the disturbed areas and the surrounding undisturbed areas. The last phase, abandonment, would begin at the end of the mining operation and would involve removal of facilities and reclaiming of all remaining disturbed areas to match surrounding topography and vegetative communities.

Off-site impacts which would adversely affect the scenic quality would be from development of access roads, rail spurs, additional power lines, haul roads, facility structures, and relocation of existing pipelines and transmission lines. Because mining plans for the intended operations have not been finalized, neither the quantity of this disturbance nor the severity of contrast with the existing basic elements of form, line, color, and texture can be determined.

The most significant visual impact would arise from the actual surface mining of coal. Surface mining would extensively change the landscape through removal and/or relocation of vegetation and large quantities of earth. Changes in the land's natural form, line, color, and texture that would create contrast between the mine and its surroundings would constitute the major visual impacts of surface mining. Assuming all applicants meet final showing, 22,020 acres on 19 of the PRLAs would be disturbed by surface mining. An additional 580 acres would be used to accommodate mine support facilities for these surface mining operations. Approximately 97 percent of these acres to be surface mined would be within areas of C-Class scenery, with the remaining in areas of A-Class scenery.

In underground mining, the severity of surface disturbance contrasts in terms of form, line, color and texture would be less than from surface mining methods. With underground mining, however, there is the potential for subsidence. If subsidence should occur, it would cause some topographic change. The recovery of coal by underground mining methods is expected to occur on 8 PRLAs, involving 26,651 acres for coal recovery and 375 acres for support facilities. Of the 26,651 acres, 14,073 acres would be on lands of A-Class scenery, 1,603 acres would be on lands of B-Class value, and the remaining 10,975 acres would be on lands of minimal scenic value or C-Class scenery.

If the applicants meet the final showing requirements, an additional 8,485 acres would be disturbed by coal mining in association with the development of the PRLAs. No mining has been proposed to occur within leases NM-6804, NM-7235 and NM-8129. These leases involve a total of 3,282 acres all of which have been identified as having C-Class scenery.

Mining operations (both surface and underground) proposed to occur within the 15,511 acres of A-Class scenery on leases NM-3834, NM-3835, NM-3838, NM-6801 and NM-6802 are expected to exceed the management objectives of the VRM Class II status of these lands and impair the ACEC designation recommendation. Management objectives for VRM Class II lands dictate that contrasts from activities not be evident on the landscape. Mining operations proposed within those public lands not having VRM classifications but having B and C scenic values would create evident visual contrasts. The lack of variety in the landscapes with B and C values would not allow higher absorption of visual modifications, unlike landscapes of A-class scenery.

The active mining disturbance and support facilities would be visible to the users of the State Highways 57, 371 and 197 that cross the region. The primary users of these routes currently are local residents, recreationists and visitors to Chaco Culture National Historical Park. The volume of use on these roads is expected to increase; however, most of the increase would be related to mineral development and the workers commuting to work in the PRLA Area. The increased vehicular traffic on unpaved roads in the region would result in greater dust and noise levels in the vicinity of these roads.

Relationship Between Short-Term Use and Long-Term Productivity

Visual impacts associated with mining operations on and off the PRLA Area would include visual contrasts created by landform alterations, vegetation removal, facility structures, powerlines, access roads, haul roads, rail spurs, and utility relocation. This would result in short-term reductions in scenic value beyond allowable contrast limits and a VRM Class V designation. A VRM Class V designation is assigned to those areas where the project or activity has disturbed the basic elements of the visual resource beyond the allowable contrast limits in the short-term (USDI, BLM 1978). This classification may be used from 20 to 40 years in duration depending on the life of the mines. It would apply until the desired higher VRM Class (arrived at through the BLM planning process not in progress) could be attained through rehabilitation.

In the long-term, facilities would be removed and disturbed surface areas reclaimed to match the surrounding topography and vegetative communities. The surface alterations of the landscape character in the Bisti Badlands would result in a long-term reduction in the A-Class scenic value, because these changes would continue to be evident as man-made intrusions rather than natural occurrences. For those lands with B- and C- Class sceneries, it is feasible that these lands could return to a similar classification in the long-term. This would depend on the perception (in terms of scenic evaluations) of the probable shift in vegetation types to meet post-mining uses, and in the sculptured landforms.

Irreversible and Irretrievable Commitments of Resources

The loss of natural surface features in the existing identified landscape units, as a result of modifications by various mining activities or support facilities, would be irretrievable.

Recommended Mitigation

1. Structures and buildings which are to remain on the lease for the duration of the mine should be painted a color that offers low contrast to colors commonly found in the surrounding landscape.
2. The revegetation edge and the clearing edge should be feathered to allow a transitional zone rather than a sharp edge.
3. VRM Class II lands on leases NM-3834, NM-3835, NM-3838, NM-6801, NM-6802, and NM-11916, should be managed so that changes in any of the existing basic elements (form, line, color, and texture) caused by mining activities and related developments would not be evident in the characteristic landscape.
4. During the recontouring process, consideration should be given to development of an asymmetrical landform composition.
5. Paving, water, chemical sealant or some other form of dust suppression should be applied to road surfaces.

SOCIAL AND ECONOMIC CONDITIONS

Impacts

The preference right leasing action itself would not have major social or economic impacts, but the actions resulting from the leasing would. These impacts can only be addressed in general terms at this time. More detailed analysis can be made when the environmental analyses are done on the mining plans.

It is assumed that some mining operations would begin as soon after leases are granted as possible, and that all lessees would be mining within ten years of the date of the lease. The companies have estimated mine life ranging from 20 to 40 years. This would indicate that at some point in time all mines would likely be operating simultaneously.

The Proposed Action would result in a company-estimated employment of 2,430 jobs directly related to mining. An additional 2,440 jobs would be generated in employment sectors other than mining. The total employment increase could be as high as 4,870 jobs.

The mining companies' expressed willingness to hire local people should have a positive effect on the high unemployment rate and the number of local people employed. However, lower education levels, reluctance to relocate, alcoholism, and an unwillingness on the part of segments of the population to be tied to a regular work schedule are the basis for estimating local hires at no more than 25 percent of the workforce or 1,217 jobs. The other 75 percent (3,653 jobs) would be filled with persons from outside the immediate area.

Using 1970 figures for the region of 1.26 workers per family, 2,899 families would in-migrate. If these families were 4.64 persons per family (Regional average, 1970) the total population increase would be 13,451 people as a result of leasing the PRLAs.

The major impacts of this population would most likely occur in the Farmington-Bloomfield area because it is the closest urban area. Other areas that would be impacted include the communities between Gallup and the PRLA Area along transportation routes, and perhaps the Grants-Milan and Cuba areas.

This population increase would be large enough to require expansion of most of the major infrastructure facilities including water, sewer, solid waste disposal, fire protection, law enforcement, social service, and transportation systems. These impacts will be assessed in detail when the timing and location of mining operation are known.

The social well-being factors (including housing, health and medical facilities, crime rates, divorce rates, and education facilities) would be impacted by a population increase of this size. However, the distribution of the population increase would be critical to the levels of impact that were felt.

The disruption of lifestyles and cultural and religious values for Navajo people living on or near the PRLAs would be the major and most direct impact to the human environment. There are estimated to be 30 families on or

adjacent to the PRLAs who would lose some or all of the following: grazing rights, points for making sacred offerings, areas for gathering herbs and sandstone used in ceremonies, family burial plots, and the specific locality in which they have lived their entire life. The cultural impacts are considered in greater detail in the Cultural Resources section of this assessment.

Another area of economic impact relates to taxation. The State of New Mexico has a severance tax of 57 cents per ton of coal plus a surcharge based on the consumer price index. As of February 17, 1981, the severance tax per ton was 72.8 cents. If this rate stayed constant, the total tax on the estimated production of coal on the PRLAs would be \$1.02 billion, or approximately \$25.6 million per year if the coal is mined in the projected 40 years.

It has been estimated that over the life of the mining to take place on the PRLAs, 22,625 acres would be disturbed. This acreage is presently producing 2,032 AUMs of grazing per year. Because it is not known when nor for how long this AUM production would be suspended by mining, the dollar loss that would occur (for any given year or for the life of the mines) cannot be determined.

The value of homes and homesteads on lands to be leased for strip mining has not been estimated.

Relationship Between Short-Term Use and Long-Term Productivity

The short-term is considered to be the surface mining period of 40 years. During this time, coal would be produced at a rate of approximately 35 million tons per year. This activity would provide growth and employment in the area but would also cause considerable social and economic impact. Probably the most critical impacts would occur to the older generation Navajo people who continue to practice their Indian religion and live in the pastoral lifestyle.

Some long-term productivity could be regained by returning the lands to livestock grazing or converting them to other economically productive uses. However, once the land is disturbed, from the Navajo religious viewpoint, it would never be the same.

Irreversible and Irretrievable Commitments of Resources

The economic value of the coal, once the coal was mined and used, would be gone. The jobs associated with mining would no longer be of potential benefit to the Region.

chapter 4

CONSULTATION & COORDINATION

CHAPTER 4

CONSULTATION AND COORDINATION

INTRODUCTION

This chapter discusses consultation and coordination that occurred during preparation of the Draft EA. The discussion includes contacts made during the development of the Proposed Action and the writing of the EA.

HISTORY OF COORDINATION EFFORTS IN THE DEVELOPMENT OF THE PROPOSED ACTION

In June 1980 the Environmental Project Staff of the BLM Albuquerque District Office spent several days touring the PRLA Area. This was to familiarize the preparers of the EA with the physical nature and setting of the area.

In the spring of 1980, a meeting was held between the BLM and the State Historic Preservation Officer. The purpose was that of consultation on the appropriate level of cultural resources inventory needed for the PRLA Area. This was necessary to ensure compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470) and the Regulations of the Advisory Council on Historic Preservation for the Protection of Historic and Cultural Properties (36 CFR 800). This meeting was also in accordance with Section IVF of the Programmatic Memorandum of Agreement between the BLM, the OSM, the USGS, and the Advisory Council (Appendix A-4). Documentation of this meeting is available in the BLM Albuquerque District Files (New Mexico Department of Finance and Administration April 16, 1980).

In early February 1981, each of the lease applicants was contacted and asked to provide additional pertinent information relating to their lease applications. In mid-February 1981 several staff members reviewed initial showing data on file with the U.S. Geological Survey in Farmington.

CONSULTATION AND COORDINATION IN THE PREPARATION OF THE DRAFT ASSESSMENT

In addition to consultation with the applicants, the BLM held an interagency meeting in Albuquerque concerning the PRLAs on October 7, 1980. The following agencies were notified of and invited to this meeting: Bureau of Indian Affairs (BIA), Navajo Area Office; Fish and Wildlife Service (FWS), Office of Ecological Services; Heritage Conservation and Recreation Service (HCRS); National Park Service (NPS); Office of the Secretary (DOI); Office of Surface Mining (OSM); U.S. Geological Survey (USGS), Conservation Division; USGS, Water Resources Division. Agencies attending the meeting were: BIA, Navajo Area Office, FWS, Office of Ecological Services; and HCRS. This meeting was held to allow representatives of federal agencies to voice their concerns about the Proposed Action and to identify potential impacts deserving of study in the environmental assessment process.

The BLM also held a meeting with the San Juan Regional Committee in Farmington on October 14, 1980. This meeting was held to determine local attitudes towards, and concerns about, the Proposed Action.

In January and February 1981, the BLM held a series of 16 scoping meetings around the state on the San Juan Basin Action Plan. This plan covers environmental analyses for seven interrelated projects in the San Juan Basin. Because of the complexities of the related elements of the various projects, the action plan presents a coordinated approach to completing the environmental analyses for them. The PRLAs are the first of these projects scheduled for environmental analysis.

Numerous comments specifically pertaining to the PRLAs were presented at the Action Plan scoping meetings. Based on these comments, it is apparent the major concerns relating to PRLAs are:

1. Navajo occupancy of parts of the PRLA Area.
2. Potential conflict between mining and preservation of archeological sites.
3. Potential conflict between mining and the possible designation of three Wilderness Study Areas.

A series of interviews was held with Navajo religious practitioners early in 1981. These interviews were carried out in order to discover potential conflicts between the religious protection afforded by the Native American Religious Freedom Act and energy development in the PRLA Area and elsewhere in the Chaco/San Juan Planning Units. These interviews were conducted by Danny Charlie and Pauline McCauley, Navajo employees of the BLM Albuquerque District, Farmington Resource Area Office. The names and residences of these participants are listed on Table 4-1. The first individual represents the Native American Church. The remaining fourteen are practitioners of various traditional Navajo ceremonies.

REVIEW OF THE DEA

Agencies, interest groups, and individuals who will be sent a copy of this DEA are listed in Table 4-2.

PUBLIC INVOLVEMENT

Public meetings (open houses) will be held by the BLM in several locations throughout New Mexico during the month of July, 1981. Topics of discussion will include the PRLA and Ute Mountain DEAs, as well as the land use planning update for the Chaco Planning Unit. A news release giving the times and locations of these meetings will be published after completion of the Draft EA. These open houses will provide the public opportunity to voice their concerns with the Proposed Action as well as the adequacy of the DEA itself.

PUBLIC COMMENTS AND RESPONSES

This section, to be prepared for the Final Environmental Assessment, will contain the comments received on the Draft Environmental Assessment. Responses to the public comments will also be included.

LIST OF PREPARERS

BLM staff members contributing to the preparation of this document are listed in Table 4-3.

TABLE 4-1

NAVAJO RELIGIOUS PRACTITIONERS INTERVIEWED BY THE BLM

Name	Residence
Raymond Arviso	Crownpoint, New Mexico
John Nez Beyale	Pueblo Pintado, New Mexico
Charley Brown	Pueblo Pintado, New Mexico
Jim Charley	Mariano Lake, New Mexico
Tom Claw	Rock Springs, New Mexico
Frank Dehiya	Mariano Lake, New Mexico
Lee Douglas	Tsaya Toh, New Mexico
Tom Johnson	Crownpoint, New Mexico
Frank and Louise Jones	Buffalo Springs, New Mexico
Bodie McCray	Tsaya Toh, New Mexico
Martha Ramone	Pueblo Pintado, New Mexico
Leo Thomas	Pueblo Pintado, New Mexico
Lloyd Thompson	St. Michaels, Arizona
Charlie Yazzie	Sand Springs, New Mexico

TABLE 4-2
DOCUMENT RECIPIENTS

Federal Government

Agencies

Department of Agriculture
Soil Conservation Service

Department of the Interior
Bureau of Indian Affairs
Albuquerque Area Office
Eastern Navajo Agency
Navajo Area Office

National Park Service
Chaco Center
Division of Remote Sensing
Indian Cultural Resources
Southwest Regional Center

Office of Surface Mining, Reclamation
and Enforcement

U.S. Fish and Wildlife Service
Office of Ecological Services

U.S. Geological Survey

Officials

Senator Pete Domenici

Senator Harrison Schmitt

Representative Manuel Lujan, Jr.

Representative Joe Skeen

Tribal Government

Navajo Nation -- Chairman Peter McDonald

Navajo Medicine Men's Association

Presidents, Navajo Off-Reservation Chapters
Baca
Crownpoint
Lake Valley
Nageezi
Ojo Encino
Pueblo Pintado
Torreon

Chairman, Jicarilla Tribe

Local Government

San Juan Regional Committee

County Commission
McKinley County
Sandoval County
San Juan County

McKinley County
Planning Department
Soil and Water Conservation District

Sandoval County
Planning Department
Soil and Water Conservation District

San Juan County
Planning Department
Soil and Water Conservation District

Mayor of Cuba

Mayor of Farmington

State Government

State of New Mexico Agencies

Bureau of Mines and Mineral Resources

Commerce and Industry Department
Economic Development Division

Department of Finance and Administration

Educational Finance and Cultural Affairs
Department
Historic Preservation Bureau

Energy and Minerals Department

Health and Environmental Department
Environmental Improvement Division

Highway Department

Natural Resources Department
Department of Game and Fish
Soil and Water Conservation Division
Water Resources Division

New Mexico Surface Mining Commission

State Clearinghouse

State Engineer

State Land Office

Officials

Governor Bruce King

Senator Christine Donisthorpe

Senator W.S. Eoff

Senator Edward A. McGough III

Senator Jack M. Morgan

Senator John Pinto

Private Groups

Special Interest Groups

National Council of Public Lands Users

National Wildlife Federation

Natural Resources Defense Council

New Mexico Archaeological Society

San Juan County Museum Association

San Juan Wildlife Federation

Sierra Club

Wildlife Management Institute

Universities

New Mexico State University

Companies

Ark Land Co.
Eastern Associated Properties Corp.
United Electric Coal Co.
Kin-Ark Corporation
Thermal Energy

Name	Report Writers			Experience
	Assignment	Education		
John C. Arwood	Livestock	BS Range Management Animal Husbandry Agricultural Economics	BLM - 12 yrs. Range Conservationist	
Tom Bargsten	Soils	BS Soil Science	BLM - 5 yrs. SCS - 11 yrs. Soil Scientist	
John E. Bristol	Visual Resources Recreation Wilderness Graphics Coordinator	BS Landscape Architecture	BLM - 4 yrs. USFS - 6 yrs. Landscape Architect	
Beverly Cochran	Socioeconomic Conditions	Ed.D. Sociology	BLM - 3 yrs. University Teaching - 10 yrs.	
Richard A. Diener	Wildlife	Ph.D. Zoology	BLM - 4 yrs. Wildlife Biologist NMFS/NOAA - 14 yrs. Fisheries Biologist	
Richard Fagan	Chief, Planning and Environmental Coordination Staff	MS Range Science BS Forest Range Management	BLM - 1 1/2 yrs. Chief, Planning and Environmental Coordination Staff 5 yrs. Area Manager	
Jim Fogg	Hydrology	BS Environmental Biology MS Watershed	BLM - 3 yrs. USFS - 1 yr. Hydrologist	
L. Kent Hamilton	Socioeconomic Conditions	BS Agricultural Economist	BLM - 4 yrs. BIA - 16 yrs. Economist and Land Use Planner	
Samuel A. Lowance	Vegetation, Climate	Ph.D. Agronomy (Weed Science)	BLM - 4 yrs. Conservation Agronomist USDA-ARS - 10 yrs Agronomist (Research Assistant)	
Steven R. Marcus	Topography and Geology	MS Geology	BLM - 7 yrs. Geologist	
Coleman R. Robison	Paleontology	Ph.D. Paleobotany	BLM - 2 yrs. Paleobotanist	
Ralph Sena	Team Leader Air Quality	BUS	BLM - 4 yrs. Environmental Coordinator	
Sarah W. Spurrier	Editing	BA Psychology	BLM - 3 1/2 yrs. Writer/Editor	
Carol Thompson	Cultural Resources	BA Anthropology	BLM - 1 1/2 yrs. Archaeologist BIA - 11 yrs. Teacher, Anthropology	

Support Personnel		
Name	Experience (BLM)	Name Experience (BLM)
Harry DeLong	2 yrs. Cartographic Aid	Karen Noling 1 1/2 yrs. Clerk Typist
Myrna Finke	1 1/2 yrs. Cartographic Aid	Eleanor Pfeifer 3 1/2 yrs. Editorial Assistant
Penelope A. Mahon	1 yr. Clerk Typist	Shirley Torres 1 yr. Supervisory Editorial Assistant
Jeffery S. Nighbert	2 yrs. District Cartographer	

APPENDICES

BACKGROUND INFORMATION

appendix A

BACKGROUND INFORMATION

Appendix A

BACKGROUND INFORMATION

APPENDIX A-1

LEGAL DESCRIPTIONS OF PRLAs

PRLA No.	Acreage	Legal Description
NM-585	2,811.17	T. 19 N., R. 5 W., Sec. 3, S ¹ / ₂ ; Sec. 4, Lots 1, 2, 3, 4, S ¹ / ₂ N ¹ / ₂ , S ¹ / ₂ ; Sec. 5, S ¹ / ₂ ; Sec. 6, Lots 6, 7, E ¹ / ₂ SW ¹ / ₄ , SE ¹ / ₄ ; Sec. 7, Lots 1, 2, E ¹ / ₂ NW ¹ / ₄ , NE ¹ / ₄ ; Sec. 8, N ¹ / ₂ ; Sec. 9, N ¹ / ₂ N ¹ / ₂ , SW ¹ / ₄ NW ¹ / ₄ , SE ¹ / ₄ NE ¹ / ₄ , S ¹ / ₂ S ¹ / ₂ , NW ¹ / ₄ SW ¹ / ₄ , NE ¹ / ₄ SE ¹ / ₄ , SW ¹ / ₄ NE ¹ / ₄ , SE ¹ / ₄ NW ¹ / ₄ , NE ¹ / ₄ SW ¹ / ₄ .
NM-3752	3,759.81	T. 23 N., R. 12 W., Sec. 17, Lot 5, W ¹ / ₂ SW ¹ / ₄ ; Sec. 18, Lots 2, 3, 4, 6, SE ¹ / ₄ NE ¹ / ₄ , SE ¹ / ₄ NW ¹ / ₄ , E ¹ / ₂ SW ¹ / ₄ , SE ¹ / ₄ ; Sec. 19, All; Sec. 20, Lots 4, 5, 6, 9-16; Sec. 21, Lots 1, 2, 3, 6, 7, 8, 9-16; Sec. 22, All; Sec. 23, Lots 1-8, S ¹ / ₂ ; Sec. 25, SE ¹ / ₄ .
NM-3753	2,950.78	T. 23 N., R. 12 W., Sec. 9, E ¹ / ₂ ; Sec. 10, Lots 1-8, E ¹ / ₂ ; Sec. 13, All; Sec. 14, Lots 1-8, N ¹ / ₂ ; Sec. 15, Lots 1-8, N ¹ / ₂ .
NM-3754	3,075.32	T. 23 N., R. 12 W., Sec. 26, NW ¹ / ₄ , N ¹ / ₂ SW ¹ / ₄ , NW ¹ / ₄ SE ¹ / ₄ ; Sec. 27, All; Sec. 28, All; Sec. 29, All; Sec. 30, Lots 1, 2, 3, 4, E ¹ / ₂ , E ¹ / ₂ W ¹ / ₂ ; Sec. 33, NE ¹ / ₄ NW ¹ / ₄ , W ¹ / ₂ W ¹ / ₂ ; Sec. 35, SE ¹ / ₄ SE ¹ / ₄ .
NM-3755	2,587.70	T. 22 N., R. 11 W., Sec. 4, SW ¹ / ₄ ; Sec. 6, All; Sec. 8, All; Sec. 10, NE ¹ / ₄ , NW ¹ / ₄ , SE ¹ / ₄ ; Sec. 12, All.
NM-3834	4,804.22	T. 24 N., R. 12 W., Sec. 20, All; Sec. 21, All; Sec. 22, All; Sec. 23, All; Sec. 24, All; Sec. 25, All; Sec. 26, All.
NM-3835	4,499.84	T. 23 N., R. 12 W., Sec. 1, All; Sec. 2, SE ¹ / ₄ ; Sec. 3, Lots 5-16, SW ¹ / ₄ ; Sec. 4, All; Sec. 5, Lots 5-12; Sec. 11, All; Sec. 12, All; Sec. 24, Lots 1-8, S ¹ / ₂ .
NM-3836	5,110.20	T. 23 N., R. 11 W., Sec. 15, All; Sec. 17, All; Sec. 18, Lots 1-4, E ¹ / ₂ , E ¹ / ₂ W ¹ / ₂ ; Sec. 19, Lots 1-4, E ¹ / ₂ , E ¹ / ₂ W ¹ / ₂ ; Sec. 20, All; Sec. 21, All; Sec. 22, All; Sec. 23, All.

APPENDIX A-I (Cont'd.)

PRLA No.	Acreage	Legal Description
NM-3837	5,120	T. 23 N., R. 11 W., Sec. 24, All; Sec. 25, All; Sec. 26, All; Sec. 27, All; Sec. 28, All; Sec. 33, All; Sec. 34, All; Sec. 35, All.
NM-3838	4,786.76	T. 24 N., R. 12 W., Sec. 27, All; Sec. 28, All; Sec. 29, All; Sec. 31, All; Sec. 33, All; Sec. 34, All; Sec. 35, All.
NM-3918	4,476.66	T. 22 N., R. 10 W., Sec. 17, All; Sec. 18, Lots 1-4, E ^{1/2} , E ^{1/2} W ^{1/2} ; Sec. 19, Lots 1-4, E ^{1/2} , E ^{1/2} W ^{1/2} ; Sec. 22, All; Sec. 23, All; Sec. 24, All; Sec. 25, All.
NM-3919	4,478.24	T. 22 N., R. 10 W., Sec. 5, Lots 1-4, S ^{1/2} N ^{1/2} , S ^{1/2} ; Sec. 6, Lots 1-7, S ^{1/2} NE ^{1/4} ; SE ^{1/4} NW ^{1/4} , E ^{1/2} SW ^{1/4} , SE ^{1/4} ; Sec. 7, Lots 1-4, E ^{1/2} , E ^{1/2} W ^{1/2} ; Sec. 8, All; Sec. 9, All; Sec. 14, All; Sec. 15, All.
NM-6801	4,394.28	T. 24 N., R. 12 W., Sec. 19, All; T. 24 N., R. 13 W., Sec. 19, Lots 1-4, E ^{1/2} , E ^{1/2} W ^{1/2} , Sec. 20, All; Sec. 21, All; Sec. 22, All; Sec. 23, All; Sec. 24, All.
NM-6802	339.98	T. 23 N., R. 12 W., Sec. 6, Lots 8-15.
NM-6803	5,120.94	T. 23 N., R. 10 W., Sec. 18, Lots 1-4, E ^{1/2} , E ^{1/2} W ^{1/2} ; Sec. 19, Lots 1-4, E ^{1/2} , E ^{1/2} W ^{1/2} ; Sec. 30, Lots 1-4, E ^{1/2} , E ^{1/2} W ^{1/2} , Sec. 31, Lots 1-4, E ^{1/2} , E ^{1/2} W ^{1/2} ; T. 23 N., R. 11 W., Sec. 10, All; Sec. 11, All; Sec. 13, All; Sec. 14, All.
NM-6804	1,601.56	T. 22 N., R. 10 W., Sec. 3, Lots 1-4, S ^{1/2} N ^{1/2} , S ^{1/2} ; Sec. 4, Lots 1-4, S ^{1/2} N ^{1/2} , S ^{1/2} ; Sec. 10, W ^{1/2} .
PNM-7235	160	T. 23 N., R. 12 W., Sec. 25, NE ^{1/4} .

APPENDIX A-I (Concluded)

PRLA No.	Acreage	Legal Description
NM-8128	4,498.56	T. 21 N., R. 8 W., Sec. 8, SE ^{1/4} SE ^{1/4} ; Sec. 9, S ^{1/2} ; Sec. 10, S ^{1/2} ; Sec. 15, All; Sec. 17, E ^{1/2} ; Sec. 22, W ^{1/2} ; Sec. 25, SW ^{1/4} ; Sec. 26, W ^{1/2} , SE ^{1/4} , SW ^{1/4} NE ^{1/4} ; Sec. 27, Lots 1-4, N ^{1/2} , SE ^{1/4} ; Sec. 34, 1-8, NE ^{1/4} , N ^{1/2} SE ^{1/4} ; Sec. 35, All.
NM-8129	1,520.36	T. 22 N., R. 9 W., Sec. 19, Lot 4, SE ^{1/4} SW ^{1/4} ; Sec. 29, NW ^{1/4} , W ^{1/2} NE ^{1/4} ; Sec. 30, Lots 1-4, E ^{1/2} , E ^{1/2} W ^{1/2} ; Sec. 33, S ^{1/2} NE ^{1/4} E ^{1/2} SW ^{1/4} , SE ^{1/4} ; Sec. 34, S ^{1/2} NW ^{1/4} , SW ^{1/4} .
NM-8130	2,133.42	T. 20 N., R. 7 W., Sec. 6, All; Sec. 7, NE ^{1/4} ; Sec. 8, SW ^{1/4} ; T. 20 N., R. 8 W., Sec. 1, All; Sec. 2, Lots 1-4, SE ^{1/4} NW ^{1/4} , S ^{1/2} NE ^{1/4} ; Sec. 3, Lots 1, 2; Sec. 12, NE ^{1/4} .
NM-8715	1,921.02	T. 20 N., R. 7 W., Sec. 3, S ^{1/2} ; Sec. 5, Lots 1-4, S ^{1/2} N ^{1/2} ; Sec. 10, All; Sec. 11, All.
NM-8717	600	T. 20 N., R. 5 W., Sec. 35, S ^{1/2} , NE ^{1/4} , E ^{1/2} NW ^{1/4} , SW ^{1/4} NW ^{1/4} .
NM-8745	520	T. 22 N., R. 10 W., Sec. 20, SE ^{1/4} NW ^{1/4} ; Sec. 21, E ^{1/2} , NW ^{1/4} .
NM-9764	240	T. 22 N., R. 10 W., Sec. 21, E ^{1/2} SW ^{1/4} , SW ^{1/4} SW ^{1/4} ; Sec. 28, N ^{1/2} NW ^{1/4} , NW ^{1/4} NE ^{1/4} .
NM-11670	1,118.55	T. 21 N., R. 8 W., Sec. 7, Lots 3, 4, E ^{1/2} SW ^{1/4} ; Sec. 17, W ^{1/2} ; Sec. 18, All.
NM-11916	2,880	T. 24 N., R. 13 W., Sec. 25, All; Sec. 26, All; Sec. 27, All; Sec. 28, E ^{1/2} ; Sec. 35, All.

Source: BLM Serial Register Pages.

APPENDIX A-2

TYPICAL METHODS OF MINING COAL

Surface Mining

The basic procedure in surface mining is to remove the rock material overlying a given coal bed so that the coal may be recovered. Several methods have been developed to remove this material: area strip mining, contour strip mining, and open-pit mining. Before any of these methods to remove coal are used, the topsoil occurring at the surface must be removed and stockpiled.

Topsoil removal is usually done with bulldozers, scrapers, or graders, depending on the terrain. The material is scraped off the area underlain by coal, and piled in an adjacent area that is not underlain by coal. It is usually necessary to stabilize the topsoil piles by grading, seeding, and irrigation to prevent wind or water erosion. The topsoil is stored until reclamation of the mined-out areas occurs, at which time the topsoil is distributed over the top of the recontoured waste rock or spoil piles and seeded.

The next step in a stripping operation is to break up the sandstone, siltstone, or shale layers that overlie the coal beds. In an area strip mining operation, after this overburden is broken up, it is removed in long, narrow strips, usually parallel to the coal outcrop. The coal exposed is removed in a swath.

Contour mining is employed in areas where the coal-bearing strata or layers have been cut into a series of ridges by stream erosion. The coal is exposed and removed in long, narrow strips as in area strip mining, but the strips are cut parallel to the configuration of the topography.

In open-pit mining, the overburden is removed by loading it into trucks and hauling it away from the mine area. There is no typical pattern in which the coal is then removed.

Underground Mining

In underground mining, access to the coal is gained either by sinking a shaft into the coal bed from the ground surface, or by tunnelling into the coal either from the outcrop or from the last strip cut of a strip mine. Two methods of underground mining are proposed in the PRLA Area, room-and-pillar-mining and longwall mining.

Room-and-Pillar Mining

Room-and-pillar-mining is accomplished by digging a series of tunnels into the coal bed at right angles to each other. The tunnels are widened to maximum extent with pillars of coal left to support the mine

roof. The size of the pillars depends on many variables such as the nature of the roof rock, the nature of the coal, and the thickness of the coal bed being mined. In some cases the pillars are removed after an area has been mined and the mine roof is allowed to collapse. Where this system is employed, surface subsidence occurs. Even where the pillars are left behind, experience has shown that over long periods of time, the pillars may fall and subsidence may still occur.

Longwall Mining

Longwall mining involves the use of movable roof supports that are arranged side by side in a long line along a tunnel in the coal bed. Mining machines dig the coal out in front of this portable roof for a few feet and as the face advances, the supports are moved forward toward the face, allowing the mine roof to collapse behind. This mining method can cause some subsidence of the ground above the mined-out area.

APPENDIX A-3
UNSUITABILITY CRITERIA
[(Title 43 CFR 3461.1(a)(1)
through (t)(1)]

§ 3461.1 Criteria for assessing lands unsuitable for all or certain stipulated methods of coal mining.

(a)(1) *Criterion Number 1.* All Federal lands included in the following land systems or categories shall be considered unsuitable: National Park System, National Wildlife Refuge System, National System of Trails, National Wilderness Preservation System, National Wild and Scenic Rivers System, National Recreation Areas, lands acquired with money derived from the Land and Water Conservation Fund, National Forests, and Federal lands in incorporated cities, towns, and villages. All Federal lands which are recommended for inclusion in any of the above systems or categories by the Administration in legislative proposals submitted to the Congress or which are required by statute to be studied for inclusion in such systems or categories shall be considered unsuitable.

(2) *Exceptions.* (i) A lease may be issued within the boundaries of any National Forest if the Secretary finds no significant recreational, timber, economic or other values which may be incompatible with the lease; and (A) surface operations and impacts are incident to an underground coal mine, or (B) where the Secretary of Agriculture determines, with respect to lands which do not have significant forest cover within those National Forests west of the 100th Meridian, that surface mining may be in compliance with the Multiple-Use Sustained-Yield Act of 1960, the Federal Coal Leasing Amendments Act of 1976 and the Surface Mining Control and Reclamation Act of 1977. (ii) A lease may be issued within the Custer National Forest with the consent of the Department of Agriculture as long as no surface coal mining operations are permitted.

(3) *Exemptions.* The application of this criterion to lands within the listed land systems and categories is subject to valid existing rights, and does not apply to surface coal mining operations existing on August 3, 1977. The application of the portion of this criterion applying to land proposed for inclusion in the listed systems does not apply to lands: to which substantial legal and financial commitments were made prior to January 4, 1977; on which surface coal mining operations

were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(b)(1) *Criterion Number 2.* Federal lands that are within rights-of-way or easements or within surface leases for residential, commercial, industrial, or other public purposes, or for agricultural crop production on Federally owned surface shall be considered unsuitable.

(2) *Exceptions.* A lease may be issued, and mining operations approved, in such areas if the surface management agency determines that:

(i) All or certain types of coal development (e.g., underground mining) will not interfere with the purpose of the right-of-way or easement; or

(ii) The right-of-way or easement was granted for mining purposes; or

(iii) The right-of-way or easement was issued for a purpose for which it is not being used; or

(iv) The parties involved in the right-of-way or easement agree, in writing, to leasing; or

(v) It is impractical to exclude such areas due to the location of coal and method of mining and such areas or uses can be protected through appropriate stipulations.

(3) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(c)(1) *Criterion Number 3.* Federal lands affected by section 522(e) (4) and (5) of the Surface Mining Control and Reclamation Act of 1977 shall be considered unsuitable. This includes lands within 100 feet of the outside line of the right-of-way of a public road or within 100 feet of a cemetery, or within 300 feet of any public building, school, church, community or institutional building or public park or within 300 feet of an occupied dwelling.

(2) *Exceptions.* A lease may be issued for lands:

(i) Used as mine access roads or haulage roads that join the right-of-way for a public road;

(ii) For which the Office of Surface Mining Reclamation and Enforcement

has issued a permit to have public roads relocated;

(iii) For which owners of occupied buildings have given written permission to mine within 300 feet of their buildings.

(3) *Exemptions.* The application of this criterion is subject to valid existing rights, and does not apply to surface coal mining operations existing on August 3, 1977.

(d)(1) *Criterion Number 4.* Federal lands designated as wilderness study areas shall be considered unsuitable while under review by the Administration and the Congress for possible wilderness designation. For any Federal land which is to be leased or mined prior to completion of the wilderness inventory by the surface management agency, the environmental assessment or impact statement on the lease sale or mine plan shall consider whether the land possesses the characteristics of a wilderness study area. If the finding is affirmative, the land shall be considered unsuitable, unless issuance of noncompetitive coal leases and mining on leases is authorized under the Wilderness Act and the Federal Land Policy and Management Act of 1976.

(2) *Exemption.* The application of this criterion to lands for which the Bureau of Land Management is the surface management agency and lands in designated wilderness areas in National Forests is subject to valid existing rights.

(e)(1) *Criterion Number 5.* Scenic Federal lands designated by visual resource management analysis as Class I (an area of outstanding scenic quality or high visual sensitivity) but not currently on the National Register of Natural Landmarks shall be considered unsuitable. A lease may be issued if the surface management agency determines that surface coal mining operations will not significantly diminish or adversely affect the scenic quality of the designated area.

(2) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(f)(1) *Criterion Number 6.* Federal lands under permit by the surface management agency, and being used for scientific studies involving food or fiber production, natural resources, or technology demonstrations and experiments shall be considered unsuitable for the duration of the study, demonstration or experiment, except where mining could be conducted in such a way as to enhance or not jeopardize the purposes of the study, as determined by the surface management agency, or where the principal scientific user or agency gives written concurrence to all or certain methods of mining.

(2) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(g)(1) *Criterion Number 7.* All districts, sites, buildings, structures, and objects of historic, architectural, archeological, or cultural significance on Federal lands which are included in or eligible for inclusion in the National Register of Historic Places, and an appropriate buffer zone around the outside boundary of the designated property (to protect the inherent values of the property that make it eligible for listing in the National Register) as determined by the surface management agency, in consultation with the Advisory Council on Historic Preservation and the State Historic Preservation Office shall be considered unsuitable.

(2) *Exceptions.* All or certain stipulated methods of coal mining may be allowed if the surface management agency determines, after consultation with the Advisory Council on Historic Preservation and State Historic Preservation Office that the direct and indirect effects of mining, as stipulated, on a property in or eligible for the National Register of Historic Places will not result in significant adverse impacts to the property.

(3) *Exemptions.* The application of this criterion to a property listed in the National Register is subject to valid existing rights, and does not apply to surface coal mining operations existing on August 3, 1977. The application of the criterion to buffer zones and properties eligible for the National Register does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(h)(1) *Criterion Number 8.* Federal lands designated as natural areas or as National Natural Landmarks shall be considered unsuitable.

(2) *Exceptions.* A lease may be issued and mining operation approved in an area or site if the surface management agency determines that:

(i) With the concurrence of the state, the area or site is of regional or local significance only;

(ii) The use of appropriate stipulated mining technology will result in no significant adverse impact to the area or site; or

(iii) The mining of the coal resource under appropriate stipulations will enhance information recovery (e.g., paleontological sites).

(3) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(i)(1) *Criterion Number 9.* Federally designated critical habitat for threatened or endangered plant and animal species, and habitat for Federal threatened or endangered species which is determined by the Fish and Wildlife Service and the surface management agency to be of essential value and where the presence of threatened or endangered species has been scientifically documented, shall be considered unsuitable.

(2) *Exception.* A lease may be issued and mining operations approved if, after consultation with the Fish and Wildlife Service, the Service determines that the proposed activity is not likely to jeopardize the continued existence of the listed species and/or its critical habitat.

(j)(1) *Criterion Number 10.* Federal lands containing habitat determined to be critical or essential for plant or animal species listed by a state pursuant to state law as endangered or threatened shall be considered unsuitable.

(2) *Exception.* A lease may be issued and mining operations approved if, after consultation with the state, the surface management agency determines that the species will not be adversely affected by all or certain stipulated methods of coal mining.

(3) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(k)(1) *Criterion Number 11.* A bald or golden eagle nest or site on Federal lands that is determined to be active and an appropriate buffer zone of land around the nest site shall be considered unsuitable. Consideration of availability of habitat for prey species and of terrain shall be included in the determination of buffer zones. Buffer zones shall be determined in consultation with the Fish and Wildlife Service.

(2) *Exceptions.* A lease may be issued if:

(i) It can be conditioned in such a

way, either in manner or period of operation, that eagles will not be disturbed during breeding season; or

(ii) The surface management agency, with the concurrence of the Fish and Wildlife Service, determines that the golden eagle nest(s) will be moved.

(iii) Buffer zones may be decreased if the surface management agency determines that the active eagle nests will not be adversely affected.

(l)(1) *Criterion Number 12.* Bald and golden eagle roost and concentration areas on Federal lands used during migration and wintering shall be considered unsuitable.

(2) *Exception.* A lease may be issued if the surface management agency determines that all or certain stipulated methods of coal mining can be conducted in such a way, and during such periods of time, to ensure that eagles shall not be adversely disturbed.

(m)(1) *Criterion Number 13.* Federal lands containing a falcon (excluding kestrel) cliff nesting site with an active nest and a buffer zone of Federal land around the nest site shall be considered unsuitable. Consideration of availability of habitat for prey species and of terrain shall be included in the determination of buffer zones. Buffer zones shall be determined in consultation with the Fish and Wildlife Service.

(2) *Exception.* A lease may be issued where the surface management agency, after consultation with the Fish and Wildlife Service, determines that all or certain stipulated methods of coal mining will not adversely affect the falcon habitat during the periods when such habitat is used by the falcons.

(n)(1) *Criterion Number 14.* Federal lands which are high priority habitat for migratory bird species of high Federal interest on a regional or national basis, as determined jointly by the surface management agency and the Fish and Wildlife Service, shall be considered unsuitable.

(2) *Exception.* A lease may be issued where the surface management agency, after consultation with the Fish and Wildlife Service, determines that all or certain stipulated methods of coal mining will not adversely affect the migratory bird habitat during the periods when such habitat is used by the species.

(o)(1) *Criterion Number 15.* Federal lands which the surface management agency and the state jointly agree are fish and wildlife habitat for resident species of high interest to the state and which are essential for maintaining these priority wildlife species shall be considered unsuitable. Examples of such lands which serve a critical function for the species involved include:

(i) Active dancing and strutting grounds for sage grouse, sharp-tailed grouse, and prairie chicken;

(ii) Winter ranges most critical for deer, antelope, and elk; and

(iii) Migration corridors for elk.

A lease may be issued if, after consultation with the state, the surface management agency determines that all or certain stipulated methods of coal mining will not have a significant long-term impact on the species being protected.

(2) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(p)(1) *Criterion Number 16.* Federal lands in riverine, coastal, and special floodplains (100-year recurrence interval) shall be considered unsuitable unless, after consultation with Geological Survey, the surface management agency determines that all or certain stipulated methods of coal mining can be undertaken without substantial threat of loss to people or property, and to the natural and beneficial values of the floodplain on the lease tract and downstream.

(2) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(q)(1) *Criterion Number 17.* Federal lands which have been committed by the surface management agency to use as municipal watersheds shall be considered unsuitable.

(2) *Exception.* A lease may be issued where:

(i) The surface management agency determines, as a result of studies, that all or certain stipulated methods of coal mining will not adversely affect the watershed to any significant degree; and

(ii) The municipality (incorporated entity) or the responsible governmental unit concurs in writing in the issuance of the lease.

(3) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(r)(1) *Criterion Number 18.* Federal lands with National Resource Waters, as identified by states in their water quality management plans, and a buffer zone of Federal lands $\frac{1}{4}$ mile from the outer edge of the far banks of the water, shall be unsuitable.

(2) *Exception.* The buffer zone may be eliminated or reduced in size where the surface management agency determines that it is not necessary to protect the National Resource Waters.

(3) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and finan-

cial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(s)(1) *Criterion Number 19.* Federal lands identified by the surface management agency, in consultation with the state in which they are located, as alluvial valley floors according to the definition in § 3400.0-5(a) of this title, the standards in 30 CFR Part 822, the final alluvial valley floor guidelines of the Office of Surface Mining Reclamation and Enforcement when published, and approved state programs under the Surface Mining Control and Reclamation Act of 1977, where mining would interrupt, discontinue, or preclude farming, shall be considered unsuitable. Additionally, when mining Federal land outside an alluvial valley floor would materially damage the quantity or quality of water in surface or underground water systems that would supply alluvial valley floors, the land shall be considered unsuitable.

(2) *Exemptions.* This criterion does not apply to surface coal mining operations which produced coal in commercial quantities in the year preceding August 3, 1977, or which had obtained a permit to conduct surface coal mining operations.

(t)(1) *Criterion Number 20.* Federal lands in a state to which is applicable a criterion (i) proposed by that state, and (ii) adopted by rulemaking by the Secretary, shall be considered unsuitable.

(2) *Exceptions.* A lease may be issued when:

(i) Such criterion is adopted by the Secretary less than 6 months prior to the publication of the draft comprehensive land use plan or land use analysis, plan, or supplement to a comprehensive land use plan, for the area in which such land is included, or

(ii) After consultation with the state, the surface management agency determines that all or certain stipulated methods of coal mining will not adversely affect the value which the criterion would protect.

(3) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

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Historic
Preservation

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Washington D.C.
20005

PROGRAMMATIC MEMORANDUM OF AGREEMENT
AMONG THE
DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT,
OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT, AND
UNITED STATES GEOLOGICAL SURVEY,
AND
THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING THE FEDERAL COAL MANAGEMENT PROGRAM

WHEREAS, the United States Department of the Interior has a program to manage federally owned coal through leasing or exchange under the Mineral Leasing Act of 1920, as amended (30 U.S.C. 181, et seq.); the Mineral Leasing Act for Acquired Lands of 1947, as amended (30 U.S.C. 351, et seq.); the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701, et seq.), which also charges the Bureau of Land Management with the management and protection of historic and cultural properties, the Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1201, et seq.), which charges the Office of Surface Mining with the obligation to ensure that surface coal mining operations are conducted so as to protect the environment; and the Federal Coal Leasing Amendments Act of 1976, as amended (30 U.S.C., Chapters 3A and 7); and

WHEREAS, the United States Department of the Interior, Bureau of Land Management, administers public lands, including Federal mineral ownership, under concepts of multiple use and sustained yield and, among other responsibilities, the Bureau of Land Management is charged with assessing the suitability of Federal lands for coal leasing, with issuing leases for mining of federally owned coal, and with including terms in each lease to protect nonmineral resources, under the above authorities; and

WHEREAS, the United States Department of the Interior, Office of Surface Mining Reclamation and Enforcement (hereinafter Office of Surface Mining), is charged, among other responsibilities, with reviewing coal mine plans (which include an exploration plan covering exploration activities within a permit area) and recommending to the Secretary approval, disapproval, or conditional approval, with reviewing and approving minor modifications to mining and reclamation plans, with designating lands

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unsuitable for surface coal mining operations or terminating such designations under a petition process, and with ensuring that surface coal mining and reclamation operations comply with certain lease terms and conditions, with approved permits, and with the provisions of the Surface Mining Control and Reclamation Act of 1977, which provides for the protection of historic and cultural properties on Federal lands (see 30 CFR 700.5 for definition of Federal lands); and

WHEREAS, the United States Department of the Interior, Geological Survey, is charged, among other responsibilities, with reviewing and approving coal exploration plans, with supervising exploration activities on Federal lands outside of a permit area, with reviewing the mining and operations portion of proposed mine plans, and with recommending mine plan approval, disapproval, or conditional approval to the Secretary; and

WHEREAS, the United States Department of the Interior, Bureau of Land Management, Geological Survey, and Office of Surface Mining have executed a memorandum of understanding implementing the division of functions and responsibilities regarding the Federal coal management program of the Department of the Interior; and

WHEREAS, Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470f), requires that the head of any Federal Agency having direct or indirect jurisdiction over a proposed Federal or federally assisted or licensed undertaking affecting properties included in, or eligible for inclusion in, the National Register of Historic Places shall afford the Advisory Council on Historic Preservation (hereinafter Council) a reasonable opportunity for comment; and

WHEREAS, coal leasing, mining, and exploration activities on Federal lands undertaken or regulated by the Bureau of Land Management, Office of Surface Mining, and Geological Survey may have an effect on properties included in, or eligible for inclusion in, the National Register of Historic Places and will require compliance with Section 106 of the National Historic Preservation Act; Section 2 of Executive Order 11593, May 13, 1971, "Protection and Enhancement of the Cultural Environment"; and the Council's regulations, "Protection of Historic and Cultural Properties" (36 CFR Part 800); and

WHEREAS, the Council has reviewed the Federal coal management program of the Department of the Interior; and

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WHEREAS, Office of Surface Mining responsibilities for regulation of coal mines on non-Federal lands, including its relationships with State Regulatory Authorities under approved State programs, will be treated in separate agreements with the Council; and

WHEREAS, the Council and the Bureau of Land Management, Office of Surface Mining, and Geological Survey have met and reviewed their respective responsibilities under the Federal coal management program of the Department of the Interior and the relation of this program to compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, including required integration with the National Environmental Policy Act of 1969 (36 CFR 800.9); Executive Order 11593, as implemented by the Council's regulations (36 CFR Part 800); and the responsibilities for historic and cultural resources under the National Environmental Policy Act of 1969 (42 U.S.C. 4321), as implemented by the Council on Environmental Quality in the "National Environmental Policy Act Regulations" (40 CFR Parts 1500-1508); and

WHEREAS, the Council's regulations, 36 CFR 800.8, provide for the development of Programmatic Memoranda of Agreement on a program or class of undertakings which would otherwise require numerous individual requests for comments;

NOW, THEREFORE, all parties mutually agree that the Bureau of Land Management, Office of Surface Mining, and Geological Survey will ensure, through the stipulations outlined in this Programmatic Memorandum of Agreement, that historic and cultural properties will be given adequate consideration in Federal coal management program decisions and implementation, which include, but are not limited to, the preparation of coal leasing environmental impact statements or environmental assessments, issuance of new leases, issuance of permits, inspection and enforcement activities, approval of exploration, and review and recommendations to the Secretary regarding plans for surface coal mining operations on either new or existing leases, thereby meeting the responsibilities of all parties under Section 106 of the National Historic Preservation Act.

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STIPULATIONS

I. Preleasing

A. Land Use Planning

1. Prior to preparation of land use plans for areas of potential Federal coal leasing, the Bureau of Land Management will ensure that a Class I (existing data cultural resource inventory) and an appropriate level of Class II (land use planning sampling field cultural resource inventory) are conducted, as defined in procedures in BLM Manual Section 8111. Inventory results will be evaluated by the Bureau of Land Management, in consultation with the appropriate State Historic Preservation Officer, to identify properties included in, or eligible for inclusion in, the National Register of Historic Places. Documentation for properties which appear to meet National Register criteria will be forwarded to the Keeper of the National Register for a determination of eligibility pursuant to 36 CFR Part 63.

2. The Bureau of Land Management will apply coal leasing unsuitability criterion 7 (43 CFR 3461.1(g)) before completion of a land use plan. Pursuant to criterion 7, all properties included in, or eligible for inclusion in, the National Register of Historic Places (under paragraph 1 above), and an appropriate buffer zone, will not be considered further for coal leasing unless the Surface Management Agency determines, after consulting with the Council and the appropriate State Historic Preservation Officer, that the direct and indirect effects of mining would not result in significant adverse effects on such a property. At the land use planning stage, this consultation with the Council and the State Historic Preservation Officer shall consist of written notification of the area of potential Federal coal leasing and of the inventory results.

B. Activity Planning

1. At an appropriate time between tract delineation and completion of a regional coal leasing final environmental impact statement, the Bureau of Land Management will conduct, or have conducted, a special project Class II (project specific) inventory or Class III (hereinafter referred to as intensive field) inventory, as defined in procedures in BLM Manual Section 8111, as the Bureau of Land Management deems necessary on a case-by-case basis. The scope of the inventories conducted for activity planning will be determined through use

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of completed land use planning Class II inventories and in consultation with the appropriate State Historic Preservation Officer. The Bureau of Land Management will evaluate, or have evaluated, the inventory results, in consultation with the appropriate State Historic Preservation Officer, to identify properties included in, or eligible for inclusion in, the National Register of Historic Places. The Bureau of Land Management will ensure that documentation for properties which appear to meet National Register criteria will be forwarded to the Keeper of the National Register with a request for a determination of eligibility pursuant to 36 CFR Part 63.

2. At an appropriate time between tract delineation and completion of a regional coal leasing final environmental impact statement, the Bureau of Land Management will apply coal leasing unsuitability criterion 7 (43 CFR 3461.1(g)) to additional properties which were identified during inventories conducted for activity planning as being included in, or eligible for inclusion in, the National Register of Historic Places. At the activity planning stage, consultation with the Council and the State Historic Preservation Officer under criterion 7 shall consist of written notification of the results of the inventories conducted for activity planning.

C. Lease Terms and Stipulations

Lease terms and special stipulations, at a minimum, will address the following concerns:

1. A lessee or designated representative will be required, as determined by the Bureau of Land Management with the concurrence of the appropriate State Historic Preservation Officer, to complete intensive field inventories of those portions of the lease tract, or portions of the mine plan area and adjacent areas, that may be affected by lease-related activities, and which were not previously inventoried at such a level of intensity. The inventory shall be conducted by a qualified cultural resource specialist approved by the Bureau of Land Management, in accordance with standards set forth in the appendix to this agreement. A report of the cultural resource inventory will be submitted to the Office of Surface Mining and the Bureau of Land Management.

2. A lessee or designated representative will be required to protect all properties included in, or eligible for inclusion in, the National Register of Historic Places from

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lease-related activities until cultural resource mitigation measures (see 3 below) can be implemented as part of an approved plan for surface coal mining operations or exploration.

3. A lessee or designated representative will be required to develop cultural resource mitigation measures which will be included as part of a mine plan submittal. The mitigation measures will provide for appropriate levels of protection from adverse effects for specific properties. The mitigation measures will include, as appropriate, provisions for data recovery, curation, detailed recordation, stabilization, and relocation.

4. If any items or features of historic, cultural, or archeological value are discovered during surface coal mining and reclamation operations, the lessee or designated representative shall immediately notify the appropriate official, as set forth in the Cooperative Procedures between the Bureau of Land Management and the Office of Surface Mining (see paragraph IV.A.).

D. Program Start-Up Considerations

Because planning is currently under way for initial lease sales to be conducted in FY 1981 and FY 1982 and because inventories may be under way or already completed, the inventory requirement may be modified by the appropriate Bureau of Land Management State Director, in consultation with the Washington Office of the Bureau of Land Management, on a case-by-case (e.g., planning unit by planning unit or delineated tract by delineated tract) basis, substituting the best information obtainable within FY 1980 and FY 1981 budget constraints and within the time available before lease issuance.

II. Mine Plan Submission, Review, and Approval

A. The Office of Surface Mining will ensure that a lessee/permittee complies with all cultural resource protection lease terms, special stipulations, and conditions of plan approval for surface coal mining operations within those areas of the lease which are included in a mine plan and adjacent areas, should a mine plan be approved. In addition, for all leases issued or readjusted after the effective date of this agreement, the Office of Surface Mining, the Geological Survey, and the Bureau of Land Management, as appropriate, will ensure compliance with cultural resource related lease terms and stipulations. After review of the more specific and complete

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findings submitted in a mine plan, the Office of Surface Mining may require more stringent protection and mitigation measures than required by 30 CFR, Chapter VII.

B. Prior to taking any Federal action on a mine plan, the Office of Surface Mining, in consultation with the Bureau of Land Management and the appropriate State Historic Preservation Officer, will identify areas within a proposed mine plan and adjacent areas which have a potential for receiving direct or indirect impacts on historic and cultural properties (determined pursuant to 36 CFR 800.3). The Office of Surface Mining, with concurrence of the appropriate State Historic Preservation Officer, will ensure that intensive field inventories have been, or will be, completed on the mine plan and adjacent areas before it recommends approval of a mine plan (see paragraph II.H.). A report of the cultural resource inventory will be submitted to the Bureau of Land Management and the Geological Survey. In the event of a failure to reach an agreement with the appropriate State Historic Preservation Officer regarding the appropriate inventory, the Office of Surface Mining will request Council review in accordance with 30 CFR 800.6.

C. If any historic or cultural properties are identified as a result of an inventory conducted pursuant to II.B., the Office of Surface Mining will consult with the Bureau of Land Management or the Surface Management Agency (if different), and then the appropriate State Historic Preservation Officer to determine if such properties are included in, or eligible for inclusion in, the National Register of Historic Places. If appropriate, documentation will be forwarded to the Keeper of the National Register with a request for a determination of eligibility in accordance with 36 CFR Part 63. Steps will be taken to preclude adverse effects on such properties until a determination of eligibility has been made. Copies of such determinations of eligibility will be submitted to the Geological Survey and the Bureau of Land Management or the Surface Management Agency (if different).

D. Before recommending approval of a mine plan, the Office of Surface Mining, in consultation with the Bureau of Land Management or the Surface Management Agency (if different), will review the applicant's proposed measures to minimize or prevent adverse effects (see 36 CFR 800.6 and 30 CFR 780.31) to historic and cultural properties and will ensure that:

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1. Inventory results have been evaluated, in consultation with the appropriate State Historic Preservation Officer, to identify properties included in, or eligible for inclusion in, the National Register of Historic Places. Documentation for properties which appear to meet National Register criteria will be forwarded to the Keeper of the National Register with a request for determination of eligibility pursuant to 36 CFR Part 63.

2. The Criteria of Effect (36 CFR 800.3(a)) have been applied in consultation with the appropriate State Historic Preservation Officer.

3. The Criteria of Adverse Effect (36 CFR 800.3(b)) have been applied, as appropriate, in accordance with the requirements of 36 CFR 800.4(b) and in consultation with the appropriate State Historic Preservation Officer.

4. Alternatives to a proposed course of action that would avoid or mitigate any adverse effect on properties included in, or eligible for inclusion in, the National Register of Historic Places have been analyzed. Documentation, including, as appropriate, photographs, maps, drawings, and specifications, and other information sufficient to constitute a preliminary case report (36 CFR 800.13(b)) enabling the consultation process to begin, shall be submitted to the appropriate State Historic Preservation Officer for review and comment. The State Historic Preservation Officer shall have 15 calendar days after receipt of documentation to inform the Office of Surface Mining and the Bureau of Land Management or the Surface Management Agency (if different) if the information provided is inadequate.

E. Avoidance/mitigation requirements, including concurrence of the appropriate State Historic Preservation Officer, will be included as part of an approved mine plan. The Office of Surface Mining will notify the Council, in writing, of agreed upon avoidance/mitigation requirements. Information shall substantially conform to the requirements of 36 CFR 800.13(b)(4), (5), (6), and (11) relating to the content of preliminary case reports. Where agreement on avoidance/mitigation requirements cannot be reached between the State Historic Preservation Officer and the Office of Surface Mining, or where a National Historic Landmark, National Historic Park, National Historic Monument, or National Historic Site will be affected, the matter will be referred to the Council, requesting the Council's involvement pursuant to 36 CFR 800.6.

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F. Mine plan approvals will contain a condition or requirement providing that, if any previously unidentified historic and cultural properties are discovered during surface coal mining operations, the operator will cease work in the immediate vicinity of the property and notify the Office of Surface Mining and shall not disturb such properties until the Office of Surface Mining issues instructions. Where there is a State/Federal cooperative agreement in effect, pursuant to section 523(c) of the Surface Mining Control and Reclamation Act of 1977, the contact point will be either the State Regulatory Authority or the Office of Surface Mining in accordance with the provisions of such a cooperative agreement.

G. Upon receiving a complete petition to designate an area as unsuitable for surface coal mining operations or to terminate a designation, the Office of Surface Mining will forward a copy of the petition for comment to the Bureau of Land Management or the Surface Management Agency (if different). The Office of Surface Mining will issue a decision on a petition pursuant to sections 522(c) and (d) of the Surface Mining Control and Reclamation Act of 1977 and 30 CFR Part 769. If the Office of Surface Mining determines that an area where a cultural resource is located should be designated as unsuitable for all or certain types of surface coal mining operations, appropriate protection measures will be developed. Decisions not to designate areas unsuitable or to terminate designations will not convey the right to conduct coal mining. Before surface coal mining operations can be conducted, a mine plan must be approved by the Secretary of the Interior, and a permit must be issued which includes compliance with 36 CFR Part 800, as outlined in this agreement.

H. During program start-up, not to exceed 6 months from the effective date of this agreement, the Office of Surface Mining will follow the procedures outlined in II.D. of this agreement, using the best information currently available, prior to recommending approval of a mine plan. The existence of resources that are of unusual significance (e.g., National Historic Landmark, National Natural Landmark) may affect recommendations for mine plan approval. Recommendations will contain the provision that surface disturbance may only occur in those portions of the area of operations which have been adequately inventoried (e.g., intensive field inventory) and any identified cultural and historic properties processed in accordance with the procedures of II.D. of this agreement. Surface disturbance in those portions of the area of operations which

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have not been adequately inventoried will not be permitted until after any additional cultural and historic inventories, as determined by the Office of Surface Mining, in consultation with the appropriate State Historic Preservation Officer, have been completed and the Office of Surface Mining has complied with all the provisions of II.D. of this agreement.

III. Exploration

A. The Geological Survey or the Bureau of Land Management, as appropriate, will require that, prior to approval of coal exploration, lessees, permittees, and licensees shall conduct, or have conducted, intensive field inventories in areas of potential environmental impact (e.g., drill holes, access routes, other surface disturbances) in a proposed exploration area, unless the area has been previously inventoried at that level of intensity. Inventory results will be evaluated, in consultation with the appropriate State Historic Preservation Officer, to identify properties included in, or eligible for inclusion in, the National Register of Historic Places. Documentation for properties which appear to meet the National Register criteria will be forwarded through the appropriate Agency to the Keeper of the National Register with a request for determination of eligibility pursuant to 36 CFR Part 63. The responsible Agency will take steps to preclude adverse effects until such a determination has been made.

B. Where there would be an adverse effect (determined pursuant to 36 CFR 800.4) on a property included in, or eligible for inclusion in, the National Register of Historic Places, the Geological Survey will consult with the Bureau of Land Management or the Surface Management Agency (if different), and the appropriate State Historic Preservation Officer and will:

1. Ensure that mutually acceptable measures to avoid or mitigate the impacts of coal exploration are developed; and

2. Notify the Council, in writing, of agreements reached under the provisions of 1 above and provide the Council with a copy of such agreements. The Council need not be afforded further opportunity for review and comment.

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C. When it is determined during B above that an affected property is a National Historic Landmark, National Historic Park, National Historic Monument, or National Historic Site, or when agreement cannot be reached between the Geological Survey or the Bureau of Land Management and the appropriate State Historic Preservation Officer on satisfactory mitigation measures, the comments of the Council will be requested in accordance with 36 CFR 800.6.

D. When approving exploration plans, licenses or permits, the Geological Survey or the Bureau of Land Management, as appropriate, will stipulate that, if any previously unidentified historic or cultural properties are discovered during exploration operations, the lessee, permittee, licensee, or operator will cease work in the immediate vicinity of the property, notify the appropriate Agency, and shall not disturb such properties until so authorized by that Agency.

E. For coal program exploration activities initiated by the Department of the Interior, with the exception of the leasing and development of lands or coal deposits held in trust for Indians by the United States, the same standards for compliance as presented in A through D above will be adhered to.

IV. Administration

A. The Bureau of Land Management will develop separate cooperative procedures with the Geological Survey and the Office of Surface Mining. These procedures, which will integrate cultural resource protection into the Federal coal management program of the Department of the Interior, will be completed no later than October 1, 1980.* The Council will be requested to review these procedures to insure continuity and consistency with this Programmatic Memorandum of Agreement.

B. This Programmatic Memorandum of Agreement and the appropriate inventory reports identifying properties included in, or eligible for inclusion in, the National Register of Historic Places will be referenced in each environmental impact statement and environmental assessment involving a Federal coal action covered by this agreement.

C. The Bureau of Land Management, Office of Surface Mining, and/or Geological Survey will provide the appropriate

*An agreement on cooperative procedures between the BLM and the USGS was signed on October 23, 1980. Final approval on cooperative procedures between the BLM and the OSM is pending.

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State Historic Preservation Officer with copies of the reports of Class I, II, and III inventories for use in the comprehensive Statewide historic preservation inventory conducted pursuant to 36 CFR Part 61.

D. At the request of the President or a Member of Congress, the Council may advise the Bureau of Land Management, Office of Surface Mining, and/or Geological Survey that a particular action, authorized by a mining or exploration permit or lease, will require individual review and comment pursuant to 36 CFR 800.6. In that event, the above Agencies will comply with the provisions of the Council's regulations.

E. This agreement is not binding on any Federal Agency which is not party to this agreement. In cases where the surface is managed by other Federal Agencies or by a private surface owner not party to this agreement, all Bureau of Land Management, Office of Surface Mining, and Geological Survey actions related to the Federal coal management program of the Department of the Interior will be conducted in accordance with 43 CFR 3400.3-1, 3400.3-3, 3461.1 criterion 1, and Subpart 3427, and with any subsequent agreements between an Agency or private surface owner and the Department of the Interior.

F. The cultural resource inventory provisions in sections I.A. and I.B. of this agreement do not apply to areas for which the Bureau of Land Management receives an application to lease coal in accordance with 43 CFR Subpart 3425 (Leasing on Application) or in accordance with 43 CFR Subpart 3430 (Preference Right Lease). For such cases, the Bureau of Land Management, in consultation with the appropriate State Historic Preservation Officer, will determine the level of cultural resource inventory to be conducted. The cultural resource inventory and mitigation requirements related to surface coal mine operation or exploration plans submitted pursuant to 43 CFR Subpart 3425 will be the same as those specified in sections I.C., I.D., II, and III of this agreement.

G. The Bureau of Land Management, Office of Surface Mining, and Geological Survey will notify the Council regarding any changes to their regulations, guidelines, or directives relative to the administration of this agreement or which may affect their authority to implement this agreement.

H. In addition to the consideration of National Register of Historic Places and Register-eligible properties covered by this agreement and 36 CFR Part 800, the Bureau of Land Management, Office of Surface Mining, and Geological Survey

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will continue to consider the full range of cultural resources as provided for in other authorities.

I. This agreement does not apply to the leasing and development of lands or coal deposits held in trust for Indians by the United States.

J. The Advisory Council on Historic Preservation, Bureau of Land Management, Office of Surface Mining, and Geological Survey will review the provisions of this agreement in 1982 and on a biennial basis thereafter to determine whether modification or termination is appropriate. Should the Federal coal management program of the Department of the Interior be revised or superseded or the regulations of the Council revised, the ratifying parties will mutually determine whether the provisions of the agreement will continue to apply.

K. This agreement is effective on the date of the last signature. The agreement may be revised or amended by mutual agreement of the signers. This agreement may be terminated by any of the undersigned parties, provided that the party initiating such termination provides a 90-day notice and reasons therefore to the other parties.

Robert Danvers Feb. 6, 1980
Executive Director, (Date)
Advisory Council on
Historic Preservation

HW Menard 27 March 80
Director, Geological (Date)
Survey

Frank Gregory 3/27/80
Director, Bureau of (Date)
Land Management

Richard W. Smith 5/20/80
Chairman, Advisory (Date)
Council on
Historic Preservation

William M. Anderson
Director, Office of (Date)
Surface Mining 4/1/80
Reclamation and Enforcement

Concurrence:
Rayce M 5/1/80
President, National (Date)
Conference of State
Historic Preservation
Officers

appendix B

TOPOGRAPHY & GEOLOGY

APPENDIX B
PRLA LANDS UNDER LEASE FOR OIL AND GAS

NM-585 T. 19 N., R. 5 W., Sec. 3, S¹/₂; Sec. 4; Sec. 5, S¹/₂; Sec. 6, S¹/₂; Sec. 7, N¹/₂; Sec. 8, N¹/₂, E¹/₂SE¹/₄; Sec. 9, SE¹/₄NE¹/₄, N¹/₂N¹/₂, SW¹/₄NW¹/₄, NW¹/₄SW¹/₄, S¹/₂S¹/₂, NE¹/₄SE¹/₄.

NM-3752 T. 23 N., R. 12 W., Sec. 17, W¹/₂W¹/₂; Sec. 18, NE¹/₄, SW¹/₄; Sec. 19; Sec. 20, W¹/₂NW¹/₄, SE¹/₄NW¹/₄, S¹/₂; Sec. 21, NE¹/₄, E¹/₂NW¹/₄, S¹/₂; Sec. 22; Sec. 23; Sec. 25, SE¹/₄.

NM-3753 T. 23 N., R. 12 W., Sec. 9, E¹/₂; Sec. 10, W¹/₂; Sec. 13; Sec. 14, NW¹/₄, S¹/₂; Sec. 15, S¹/₂.

NM-3754 T. 23 N., R. 12 W., Sec. 26, NW¹/₄, N¹/₂SW¹/₄, W¹/₂SE¹/₄; Sec. 27; Sec. 28; Sec. 29; Sec. 30; Sec. 35, SE¹/₄.

NM-3755 T. 22 N., R. 11 W., Sec. 6; Sec. 10, SE¹/₄; Sec. 12.

NM-3834 T. 24 N., R. 12 W., Sec. 20; Sec. 21; Sec. 22; Sec. 23; Sec. 24; Sec. 25; Sec. 26.

NM-3835 T. 23 N., R. 12 W., Sec. 1; Sec. 3, N¹/₂, SE¹/₄; Sec. 4; Sec. 5, N¹/₂; Sec. 12; Sec. 24.

NM-3836 T. 23 N., R. 11 W., Sec. 15; Sec. 17; Sec. 18; Sec. 19; Sec. 20; Sec. 21; Sec. 22; Sec. 23.

NM-3837 T. 23 N., R. 11 W., Sec. 24, E¹/₂, NW¹/₄; Sec. 25, W¹/₂, SE¹/₄; Sec. 26; Sec. 27; Sec. 28; Sec. 33; Sec. 34; Sec. 35.

NM-3838 T. 24 N., R. 12 W., Sec. 27; Sec. 28; Sec. 29; Sec. 31; Sec. 33; Sec. 34; Sec. 35.

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PRLA LANDS UNDER LEASE FOR OIL AND GAS

NM-3918 T. 22 N., R. 10 W., Sec. 17; Sec. 18; Sec. 19; Sec. 22; Sec. 23; Sec. 24; Sec. 25.

NM-3919 T. 22 N., R. 10 W., Sec. 5; Sec. 6; Sec. 7; Sec. 8, NE¹/₄, S¹/₂ (NW¹/₄ is under Oil and Gas Lease Application); Sec. 9; Sec. 14; Sec. 15.

NM-6801 T. 24 N., R. 12 W., Sec. 19.
T. 24 N., R. 13 W., Sec. 19; Sec. 20; Sec. 21, NE¹/₄, S¹/₂; Sec. 22; Sec. 23; Sec. 24.

NM-6803 T. 23 N., R. 10 W., Sec. 18; Sec. 19; Sec. 30; Sec. 31.
T. 23 N., R. 11 W., Sec. 10; Sec. 11; Sec. 13; Sec. 14.

NM-6804 T. 22 N., R. 10 W., Sec. 3; Sec. 4; Sec. 10, W¹/₂.

NM-7235 T. 23 N., R. 12 W., Sec. 25, NE¹/₄.

NM-8128 T. 21 N., R. 8 W., Sec. 8, SE¹/₄SE¹/₄; Sec. 9, S¹/₂; Sec. 10, SW¹/₄; Sec. 17, E¹/₂, E¹/₂W¹/₂; Sec. 22; Sec. 25, SW¹/₄; Sec. 26, SW¹/₄NE¹/₄, NW¹/₄, SE¹/₄; Sec. 27; Sec. 34, N¹/₂, NE¹/₄SW¹/₄, S¹/₂SW¹/₄; Sec. 35.

NM-8129 T. 22 N., R. 9 W., Sec. 19, S¹/₂SW¹/₄; Sec. 29, W¹/₂NE¹/₄, NW¹/₄; Sec. 30; Sec. 33, S¹/₂NE¹/₄, W¹/₂SW¹/₄, SE¹/₄; Sec. 34, S¹/₂NW¹/₄, SW¹/₄.

NM-8130 T. 20 N., R. 7 W., Sec. 6; Sec. 7, NE¹/₄; Sec. 8, SW¹/₄.
T. 20 N., R. 8 W., Sec. 3, N¹/₂NE¹/₄; Sec. 12, NE¹/₄.

APPENDIX B (concluded)
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NM-8715	T. 20 N., R. 7 W., Sec. 3, S ¹ / ₂ (S ¹ / ₂ N ¹ / ₂ is under Oil and Gas Lease Application); Sec. 5, N ¹ / ₂ ; Sec. 10; Sec. 11.
NM-8745	T. 22 N., R. 10 W., Sec. 21, N ¹ / ₂ .
NM-9764	T. 22 N., R. 10 W., Sec. 28, NW ¹ / ₄ NE ¹ / ₄ .
NM-11670	T. 21 N., R. 8 W., Sec. 7, SW ¹ / ₄ ; Sec. 17, W ¹ / ₂ W ¹ / ₂ ; Sec. 18.
NM-11916	T. 24 N., R. 13 W., Sec. 25, N ¹ / ₂ , N ¹ / ₂ SW ¹ / ₄ , SE ¹ / ₄ ; Sec. 26; Sec. 27, W ¹ / ₂ ; Sec. 35.

Source: BLM, Serial Register Pages.

appendix C

VEGETATION

APPENDIX C-1

DESCRIPTIONS OF VEGETATION SITES

Loamy-Sagebrush

The Loamy-Sagebrush site occurs in the middle and eastern portions of the PRLA Area. This site occurs on areas that are level to moderately sloping (0 to 9 percent), with occasional swales.

The vegetation is typically a sagebrush-grassland. Big sagebrush dominates the overstory except in small areas containing alkaline soils where fourwing saltbush is the dominant. Other common shrubs on this site include rubber rabbitbrush, winterfat, pricklypear cactus, yucca and broom snakeweed. Grasses common to this site are blue grama, galleta, and bottlebrush squirreltail. Less frequently found grasses include sand dropseed, Indian ricegrass, red threeawn, and alkali sacaton. Russian thistle, scarlet globemallow, and wooly Indian-wheat are forbs commonly occurring on this site.

Loamy Bottom-Sagebrush

This site occupies nearly level to gently sloping areas on wide upland valley bottoms. The site is occupied by plant communities dominated by big sagebrush and black greasewood.

The big sagebrush community is located on gentle slopes of upland valleys. Major plant species associated with big sagebrush include galleta, blue grama, bottlebrush squirreltail, sand dropseed, broom snakeweed, and winterfat. Less abundant species are Indian ricegrass, needle-and-thread, wild buckwheat, rabbitbrush species, and pricklypear cactus.

The black greasewood community is located in the valley bottoms associated with sodium affected soils. This community commonly contains an understory of alkali sacaton, galleta, and western wheatgrass.

Sandy-Sagebrush

The Sandy-Sagebrush vegetation site occurs in the east-central portion of the PRLA Area. It is found on gently to strongly sloping (3 to 16 percent) uplands.

Big sagebrush is the dominant plant of this site. Associated shrubs include fourwing saltbush, pale wolfberry, rabbitbrush species, broom snakeweed, and pricklypear cactus. The common understory species of grasses and forbs are galleta, sand dropseed, bottlebrush squirreltail, Indian ricegrass, blue grama, stickseed, globemallow species, wirelettuce, and wild buckwheat.

Deep Sand-Grassland-Saltbush

This site occurs mainly in the western portion of the PRLA Area. The terrain ranges from nearly level to gently sloping (0 to 8 percent) undulations.

The aspect of the vegetation is characterized by shrub species mixed with short and mid-grasses. Shrub species which are most common on deep sand upland areas are fourwing saltbush, pale wolfberry, Mormon-tea, and various species of cacti

APPENDIX C-1 (Cont'd)

and rabbitbrush. Indian ricegrass, galleta, sand dropseed, giant dropseed, spike dropseed, spike muhly, red threeawn, and blue grama comprise the majority of the grasses. Forbs are common on the upland areas. These include penstemon, wild buckwheat, stickseed, spectaclepod, globemallow, dock, wirelettuce, cryptantha, phacelia, and milkvetch.

Shallow, sodium-affected soils of this site support a sparse stand of vegetation. Species common to these areas are fourwing saltbush, black greasewood, shadscale, mound saltbush, broom snakeweed, alkali sacaton, galleta, western wheatgrass, and wild buckwheat. After summer showers, stands of annuals develop on these areas. Common annual plants are Russian thistle, sixweeks grama, cocklebur, and various species of aster.

Sodic Slopes-Grassland

The sodic slopes-grassland site occupies level to gently sloping mesas and valleys at scattered locations throughout the PRLA Area. The general vegetation aspect is grassland-shrub. However, some separation of life form occurs in that shrubs tend to dominate on uplands while grasses dominate in swales. High levels of exchangeable sodium in the soils limits the density and productivity of the vegetation on this site.

The dominant species of grass varies with locale, but include alkali sacaton, galleta, Indian ricegrass, sand dropseed, bottlebrush squirreltail, needle-and-thread, and red threeawn. The common shrubs are black greasewood, fourwing saltbush, rabbitbrush, winterfat, broom snakeweed, shadscale, and mound saltbush.

Forbs and annual grasses become abundant following measurable precipitation. The species most common are Russian thistle, wild buckwheat, sixweeks grama, sixweeks fescue, fluffgrass, and cheatgrass.

On areas of this site that have been severely overgrazed, broom snakeweed has become the dominant species.

Shallow-Pinyon-Juniper

This site is characterized by shallow soils with frequent rock outcrops. The site occupies hills, ridges, breaks, and escarpments with slopes up to 30 percent. Sandstone and shale outcrops comprise over 15 percent of the area in the form of barren exposed cliffs, caps, and ledges.

The most obvious component of the vegetation is scattered pinyon and juniper trees with a sparse understory. Shrubs that occur on this site are antelope bitterbrush, serviceberry, Mormon-tea, true mountain-mahogany, rabbitbrush, big sagebrush, soapweed and winterfat. The most common grasses are blue grama, galleta, sand dropseed, and western wheatgrass. Wild buckwheat, pingue, groundsel, goldenrod, spectaclepod, and many-flowered four o'clock are the most common forbs.

APPENDIX C-1 (Cont'd)

Sandy to Shallow-Pinyon-Juniper

This site is located in small scattered patches and strips in the mid-portion of the PRLA Area. The area is undulating to hilly on breaks, ridgecrests, and escarpments. The slopes range from moderate to steep (5 to 30 percent). Rock outcrops comprise less than 5 percent of the site. The overstory vegetation consists of scattered pinyon and juniper trees. The understory is a mixture of shrubs and grasses of which big sagebrush, rabbitbrush, Mormon-tea, galleta, blue grama, Indian ricegrass, and needle-and-thread are the major species. Less common species found on this site are antelope bitterbrush, serviceberry, fourwing saltbush, pale wolfberry, red threeawn, bottlebrush squirreltail, and spike muhly.

Salt Flats-Halophytic

Areas comprising this site are located on floodplains, bottomlands, and alluvial fans of major drainage ways in the eastern portion of the PRLA Area. This site occurs on nearly level to gently sloping areas with soils that are moderately to strongly alkaline and/or sodium affected.

The vegetation consists of perennial grasses with scattered shrubs and many species of annuals. Alkali sacaton, galleta, inland saltgrass, black greasewood, fourwing saltbush, and shadscale comprise the major portion of the vegetation in areas of good range condition. Other associated perennial species include western wheatgrass, bottlebrush squirreltail, blue grama, sand dropseed, rabbitbrush, mound saltbush, and big sagebrush. On areas where this site has been disturbed or has been grazed heavily for extended periods, there is a marked increase in proportion of shrubs and annual plants. The shrub increase is most notable by increased abundance of black greasewood, and invasion of broom snakeweed and cacti species. Annual species common to this site are red muhly, cheatgrass, fluffgrass, sixweeks fescue, sixweeks grama, Russian thistle, sunflower, wooly Indian-wheat, tansymustard, cocklebur, and Rocky Mountain beeplant.

Badlands

The badlands site is characterized by rolling to very steep, nonstony, barren hills, breaks, canyons, and valleys where shale is exposed or lies close to the surface. The soils are high in clay content and are highly resistant to water infiltration.

The vegetation of this site is very sparse and generally restricted to flat areas along intermittent channels which dissect badland areas. Alkali sacaton and galleta comprise virtually all the grasses of this site. Shrubs found here are black greasewood, shadscale, mound saltbush, fourwing saltbush, broom snakeweed, rabbitbrush, and Mormon-tea. The principal forbs are Russian thistle, wild buckwheat, annual saltbush species, four- o'clock, and various composite species.

Duneland

This site is located adjacent to major washes in the mid-portion of the PRLA Area. It is characterized by deep, excessively drained, gently to moderately

APPENDIX C-1 (Concluded)

sloping, shifting sand masses. The vegetation is sparse with woody species dominating. Species occupying this site include black greasewood, fourwing saltbush, giant dropseed, Indian ricegrass, and alkali sacaton.

Riverwash-Wetland

This site is located in the washes in the mid-portion of the PRLA Area. These washes flow intermittently, but are dry the majority of the year. Soils consist of unconsolidated alluvium, recently deposited, whose texture varies widely and is subject to frequent change.

The majority of the vegetation is located along the edges of the virtually barren channels. These edges often have a high watertable and support riparian vegetation. The most common species are cottonwood, saltcedar, Russian olive, sedges, rushes, inland saltgrass, western wheatgrass, and numerous forbs.

ACREAGE DISTURBANCE ON PRLAS BY ALLOTMENT, VEGETATIVE TYPE AND AUMs

Allot. No.	PRLA No.	L-S		LB-S		S-S		DS-GS		SS-G		S-PJ		SS-PJ		SF-H		BA		Du		RW		TOTALS	
		Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs
6008	11916 Totals																	125 125	7 7					125 125	7 7
6009	6802 Totals																	253 253	14 14					340 340	23 23
6010	3919 3755 3837 3836 3835 3838 3752 3753 Totals																	350 320 100 60 320 20 580 1,750	19 17 5 3 17 1 31 93					350 580 1,780 1,920 3,380 60 100 1,180 9,350	19 51 198 191 344 6 13 75 897
6011	No acreage disturbance																								
6012	3752 3754 Totals																	1,100 380 1,480	59 20 79					1,520 740 2,260	85 42 127
6013	3918 3919 3755 8745 9764 Totals																	110 1,097 320 1,527	6 59 17 82					1,940 1,550 360 4,100	200 109 21 18 354
6015	8715 Totals																							150 150	13 13
6016	No acreage disturbance																								
6017	8128 11670 Totals																	44 44 130	2 2 9					50 80 130	2 7 9
6018	8130 8128 Totals																							174 228 402	
6019	8715 Totals																							38 38	
6023	8717 585 Totals																							40 122 162	
NIIP	No acreage disturbance																								
GRAND TOTALS	1,997	202	4,693	413	527	42	6,751	873	1,745	105	0	0	0	0	0	0	878	75	5,954	319	80	3	22,625	2,032	

Source: Applicants initial showing information, 1980.

appendix D

CLIMATE

Appendix D

CLIMATE

APPENDIX D-1

ANNUAL PRECIPITATION AND FROST-FREE DAYS FOR YEARS OF RECORD
(1950 through 1978)

Weather Station	Number of Years of Record	Precipitation (Inches)		Frost-Free Days (No. per Year)		
		Annual Average	High (Year)	Low (Year)	Annual Average	Greatest (Year)
Chaco Culture National Historical Park	27	8.23	13.72 (1978)	3.35 (1950)	116	179 (1957)
Lybrook	26	10.68	20.67 (1957)	2.47 (1955)	142	186 (1965)
Otis	21	9.25	14.33 (1969)	6.78 (1973)	148	187 (1963)
Star Lake	24	8.17	12.85 (1965)	3.85 (1956)	111	148 (1956)
Torreón Mission	17	9.54	14.09 (1972)	5.59 (1976)	145	186 (1963)
						71 (1968)
						98 (1973)
						111 (1971)
						74 (1967)
						110 (1971)

Source: National Oceanic and Atmospheric Administration, 1950-1978.

APPENDIX D-2

AVERAGE MONTHLY AND ANNUAL PRECIPITATION AND TEMPERATURE FOR YEARS OF RECORD
(1950 through 1978)

Weather Station	Monthly Averages											Annual Average	
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.		Dec.
Chaco Culture Natl. Hist. Park	Ppt.	.36	.39	.48	.37	.51	.39	1.14	1.27	1.11	1.09	.54	8.23
	Temp.	27.4	33.3	38.9	47.1	60.5	66.5	72.8	70.2	60.3	50.9	37.6	49.4
Lybrook	Ppt.	.66	.63	.79	.41	.52	.43	1.31	2.12	1.10	1.12	.74	10.68
	Temp.	26.4	30.1	36.6	44.9	54.7	62.3	67.1	64.5	65.0	47.9	35.4	46.2
Otis	Ppt.	.39	.44	.50	.38	.40	.62	1.46	1.69	.99	1.34	.48	9.25
	Temp.	26.4	32.2	38.2	46.2	56.6	66.3	71.7	68.9	61.6	50.9	38.3	48.9
Star Lake	Ppt.	.31	.32	.37	.27	.51	.43	1.36	1.84	1.03	.91	.42	8.17
	Temp.	24.6	30.2	37.1	45.3	52.3	64.2	69.8	67.4	60.0	48.9	36.0	46.8
Torreon Mission	Ppt.	.43	.52	.52	.36	.58	.50	1.48	1.82	1.35	.97	.65	9.72
	Temp.	25.1	32.9	39.5	47.5	57.5	67.0	72.7	69.6	62.2	51.6	39.0	49.4

Source: National Oceanic and Atmospheric Administration, 1950-1978.

appendix E

SOILS

APPENDIX E-1

PHYSICAL AND CHEMICAL CHARACTERISTICS OF SOILS

Soil, Soils Association Percent of or Land Type	Depth to Bedrock (In.)	Texture		Reaction (pH)	Permea- bility (In./Hr.)	Waterholding Capability (In./In.)	Salinity (MMHOS/CM)
		Surface	Underlying Layer				
1. Chipeta-Sheppard- Shiprock							
Chipeta	58	10 - 20	clay, clay loam	shale	7.4 - 8.4	0.06 - 0.2	0.15 - 0.17
Sheppard	17	60	loamy fine sand	loamy fine sand	7.4 - 8.4	6.0 - 20.0	0.05 - 0.08
Shiprock	10	60	sandy clay loam	sandy loam	7.4 - 8.4	2.0 - 6.0	0.05 - 0.12
Other soils, land types	15	-	-	-	-	-	-
2. Badland-Rockland							
Badland	50	-	-	-	-	-	-
Rockland	20	-	-	-	-	-	-
Alluvial Land	10	-	-	-	-	-	-
Persayo	5	10 - 20	silty clay loam	shale	7.9 - 8.4	0.2 - 0.6	0.15 - 0.19
Other soils, land types	15	-	-	-	-	-	-
3. Billings-Badlands							
Billings	35	72	clay loam	clay loam	7.4 - 9.0	0.06 - 0.2	0.14 - 0.19
Badland	20	-	-	-	-	-	-
Farb	20	10 - 20	sandy loam	sandy loam	7.4 - 8.4	2.0 - 6.0	0.05 - 0.11
Azfield	10	60	fine sandy loam	sandy loam	7.4 - 8.4	0.6 - 6.0	0.11 - 0.17
Other soils, land types	15	-	-	-	-	-	-
4. Doak-Shiprock							
Doak	55	60	fine sandy loam	loam	7.4 - 9.0	0.2 - 2.0	0.13 - 0.19
Shiprock	30	60	fine sandy loam	sandy loam	7.4 - 8.4	0.6 - 6.0	0.09 - 0.12
Other soils, land types	15	-	-	-	-	-	-

APPENDIX E-1 (Cont'd)

Soil, Soils Association Percent of or Land Type	Percent of Association	Slope Percent	Depth to Bedrock (In.)	Texture		Reaction (pH)	Permea- bility (In./Hr.)	Waterholding Capacity (In./In.)	Salinity (MMHOS/CM)
				Surface	Underlying Layer				
5. Camborthids-Farb									
Camborthids	50	1 - 9	20 - 40	fine sandy loam	fine sandy loam	7.4 - 8.4	2.0	0.08 - 0.13	< 2
Farb	30	3 - 30	10 - 20	sandy loam	sandy loam	7.4 - 8.4	2.0	0.05 - 0.11	< 2
Other soils, land types	20	-	-	-	-	-	-	-	-
6. Rockland-Billings									
Rockland	55	30 - 75	-	-	-	-	-	-	-
Billings	15	0 - 5	72	clay loam	clay loam	7.4 - 9.0	0.06	0.14 - 0.19	2 - 4
Lotmiller	10	0 - 3	60	silty loam	silty loam	7.4 - 9.0	0.06	0.13 - 0.18	4 - 16
Farb	10	3 - 30	10 - 20	sandy loam	sandy loam	7.4 - 8.4	2.0	0.05 - 0.10	2 - 4
Other soils, land types	10	3 - 30	-	-	-	-	-	-	-
7. Persayo-Billings									
Persayo	60	0 - 15	10 - 20	silty clay loam	silty clay loam	7.9 - 8.4	0.2	0.15 - 0.19	2 - 8
Billings	25	0 - 5	72	silty clay loam	clay loam	7.4 - 9.0	0.06	0.14 - 0.19	2 - 4
Lotmiller	15	0 - 3	60	clay loam	silty clay	7.4 - 9.0	0.06	0.13 - 0.18	4 - 16
8. Shiprock-Sheppard									
Shiprock	35	0 - 5	60	fine sandy loam	sandy loam	7.4 - 8.4	0.6	0.09 - 0.12	2 - 4
Sheppard	20	1 - 9	60	fine sand	loamy fine sand	7.4 - 8.4	6.0	0.05 - 0.08	< 2
Nageezi	10	0 - 5	10 - 20	sandy loam	sandy loam	7.9 - 8.4	2.0	0.10 - 0.13	< 4
Kinnear	12	1 - 9	60	fine sandy loam	sandy clay loam	7.4 - 8.4	0.6	0.11 - 0.15	< 4
Camborthids	10	1 - 9	60	fine sandy loam	sandy clay loam	6.6 - 7.4	0.6	0.11 - 0.14	< 4
Other soils, land types	13	-	-	-	-	-	-	-	-

APPENDIX E-1 (Concluded)

Soil, Soils Association Percent of or Land Type	Association	Slope Percent	Depth to Bedrock (In.)	Texture		Reaction (pH)	Permea- bility (In./Hr.)	Waterholding Capacity (In./In.)	Salinity (MMHOS/CM)
				Surface	Underlying Layer				
9. Penistaja-Pinavetes									
Penistaja	45	3 - 5	60	fine sandy loam	sandy clay loam	6.6 - 8.4	0.6	0.09	0.16
Pinavetes	25	3 - 9	60	loamy sand	sandy loam	7.0 - 7.3	6.0	0.05	0.08
Rockland	15	9 - 60	-	-	-	-	-	-	0 - 2
Other soils, land types	15	3 - 15	-	-	-	-	-	-	-
10. Persayo-Lohmiller									
Persayo	35	5 - 25	10 - 20	silty clay loam	silty clay loam	7.9 - 8.4	0.2	0.15	0.19
Lohmiller	30	0 - 3	60	clay loam	clay loam	7.4 - 9.0	0.06	0.13	0.18
Badland	15	-	-	-	-	-	-	-	-
Other soils, land types	20	10 - 75+	-	-	-	-	-	-	-
11. Hagerman-Travesilla									
Hagerman	35	1 - 5	20 - 40	sandy clay loam	sandy clay loam	6.6 - 8.4	0.6	0.14	0.16
Travesilla	20	3 - 25	6 - 20	fine sandy loam	fine sandy loam	7.4 - 8.4	2.0	0.06	0.17
Rockland	20	25 - 75+	-	-	-	-	-	-	-
Other soils, land types	25	-	-	-	-	-	-	-	-

Source: USDA, Soil Conservation Service, 1977.

APPENDIX E-2

INTERPRETATIONS FOR SELECTED USES OF MAJOR SOILS

Soil or Land Type	Erosion Hazard	Shrink Swell	Limitation for Use As						Suitability As A Source Of		
			Septic Tank Filter Fields	Sewage Lagoons Settling Ponds	Sanitary Landfills	Shallow Excavations	Embankments	Topsoil	Roadfill	Sand/Gravel	
Badland	high	NO INTERPRETATIONS MADE									
Billings	moderate	moderate	severe-permeability	moderate-piping	moderate-too clayey	moderate-clayey	low strength, piping	fair-too clayey	poor-low strength, shrink-swell	unsuited	
Camborthids	moderate	low	severe-depth	severe-depth seepage	severe-depth	severe-depth	thin layer, piping	fair-thin layer	poor-thin layer, depth	unsuited	
Chipeta	moderate	high	severe-depth	severe-depth permeability	severe-depth	severe-depth	low strength, piping	poor-thin layer, too clayey	poor-low strength, shrink-swell	unsuited	
Doak	moderate	moderate	severe-permeability	0-2% slight moderate-slope	slight	slight	shrink-swell, low strength	fair-too clayey	poor-low strength	unsuited	
Farb	high	low	severe-depth	severe-depth, seepage	severe-depth	severe-depth	piping, erodes easily	poor-thin layer	poor-thin layer	unsuited	
Hagerman	moderate	moderate	severe-depth	severe-depth	severe-depth	severe-depth	thin layer, low strength	poor-thin layer	poor-thin layer, low strength	unsuited	
Lohmiller	moderate	high	severe-permeability	severe-floods	severe-too clayey	moderate-too clayey, floods	low strength, shrink-swell	fair-too clayey	poor-low strength, shrink-swell	unsuited	

APPENDIX E-2 (Concluded)

Soil or Land Type	Limitation for Use As										Suitability As A Source Of		
	Erosion Hazard	Shrink Swell	Septic Tank Filter Fields	Sewage Lagoons Settling Ponds	Sanitary Landfills	Shallow Excavations	Embankments	Topsoil	Roadfill	Sand/Gravel			
Penistaja	moderate	moderate	slight	moderate-seepage	slight	slight	low strength, piping	fair	fair-low strength	unsuited			
Persayo	high	high	severe-depth	severe-depth	severe-depth	moderate-depth	thin-layer, compressible	poor-thin layer, too clayey	poor-thin layer, shrink-swell	unsuited			
Pinavetes	high	low	slight	severe-seepage	moderate-seepage	severe-cut-banks cave	seepage, piping	poor-too sandy	good	poor/unsuited			
Rockland	low	NO	NO	INTERPRETATIONS MADE									
Sheppard	high	low	slight	severe-seepage	moderate-seepage	severe-cut-banks cave	seepage, piping	poor-too sandy	good	poor/unsuited			
Shiprock	moderate	low	slight	severe-seepage	moderate-seepage	slight	piping, seepage	fair	fair-low strength	poor/unsuited			
Travessilla	high	low	severe-depth	severe-depth	severe-depth	severe-depth	piping, thin layer erodes easily	poor-thin layer	poor-thin layer	unsuited			

Source: USDA, Soil Conservation Service, 1977

appendix F

WATER RESOURCES

FIGURE F-1

FLOW-DURATION CURVE

08334300 PAPERS WASH NEAR STARLAKE TRADING POST, NM

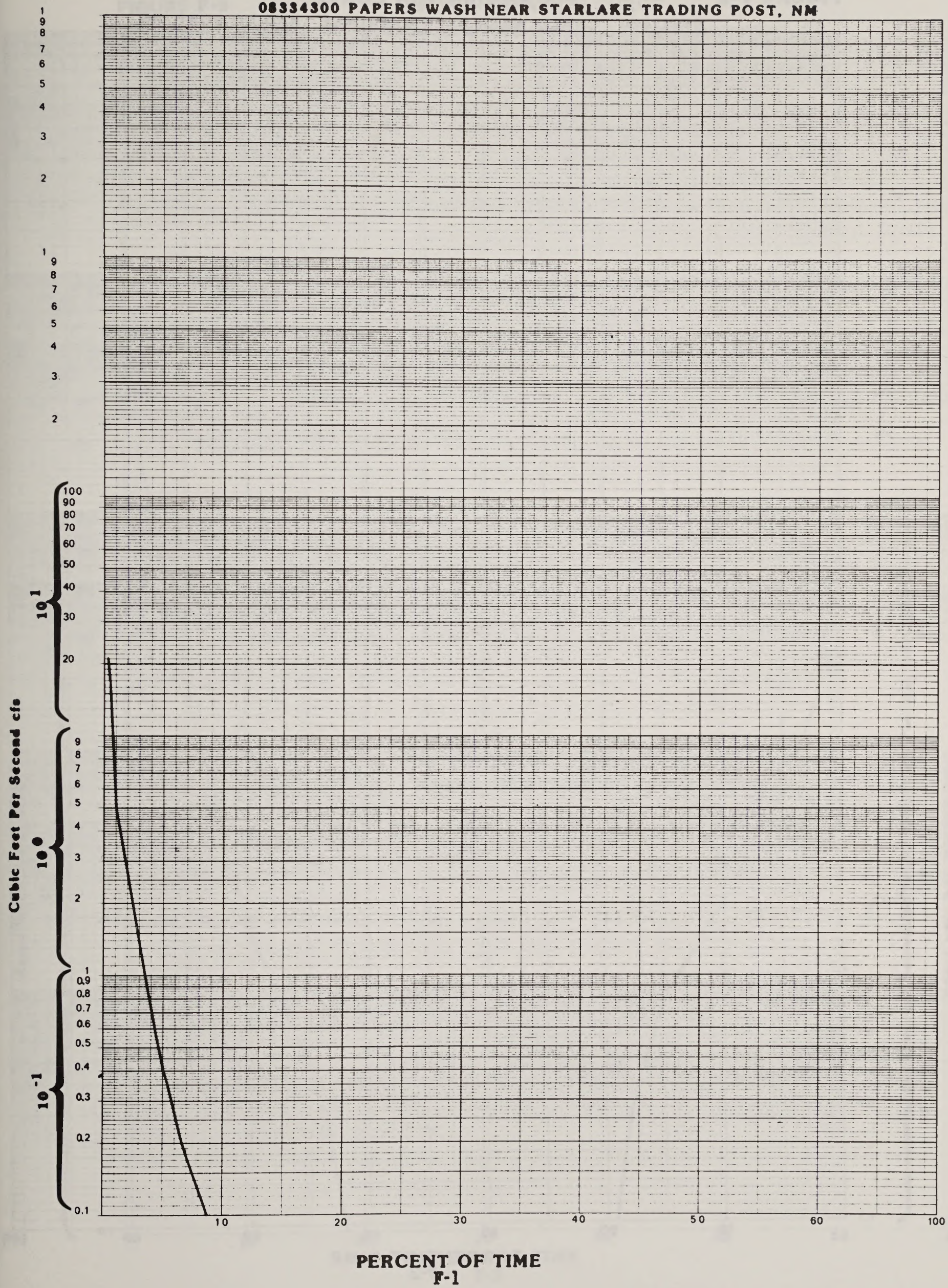


FIGURE F-2

FLOW-DURATION CURVE

09367660 - CHACO WASH NEAR STARLAKE TRADING POST, NM

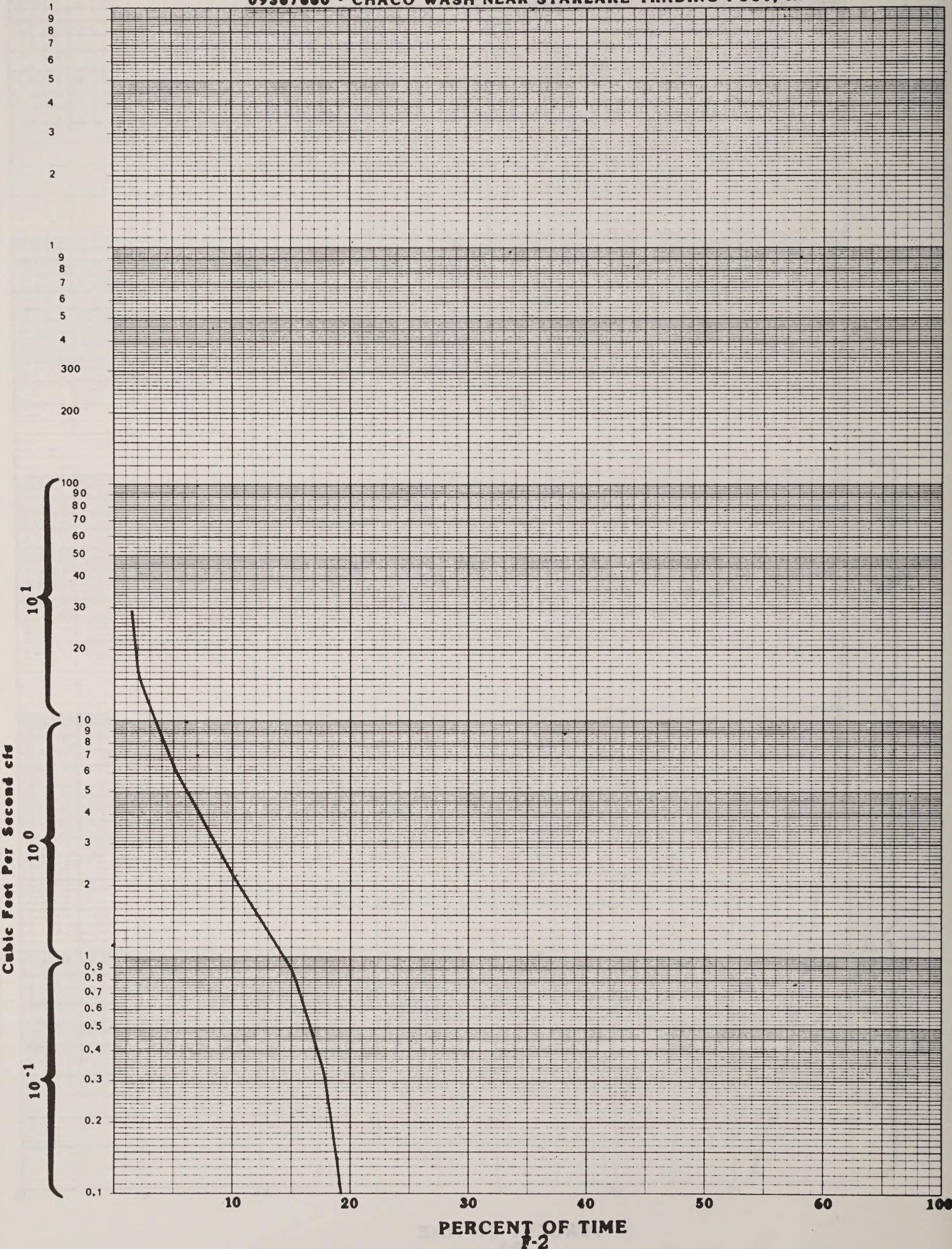


FIGURE F-3

FLOW-DURATION CURVE

09367680 CHACO WASH AT CHACO CANYON NATIONAL MONUMENT, NM

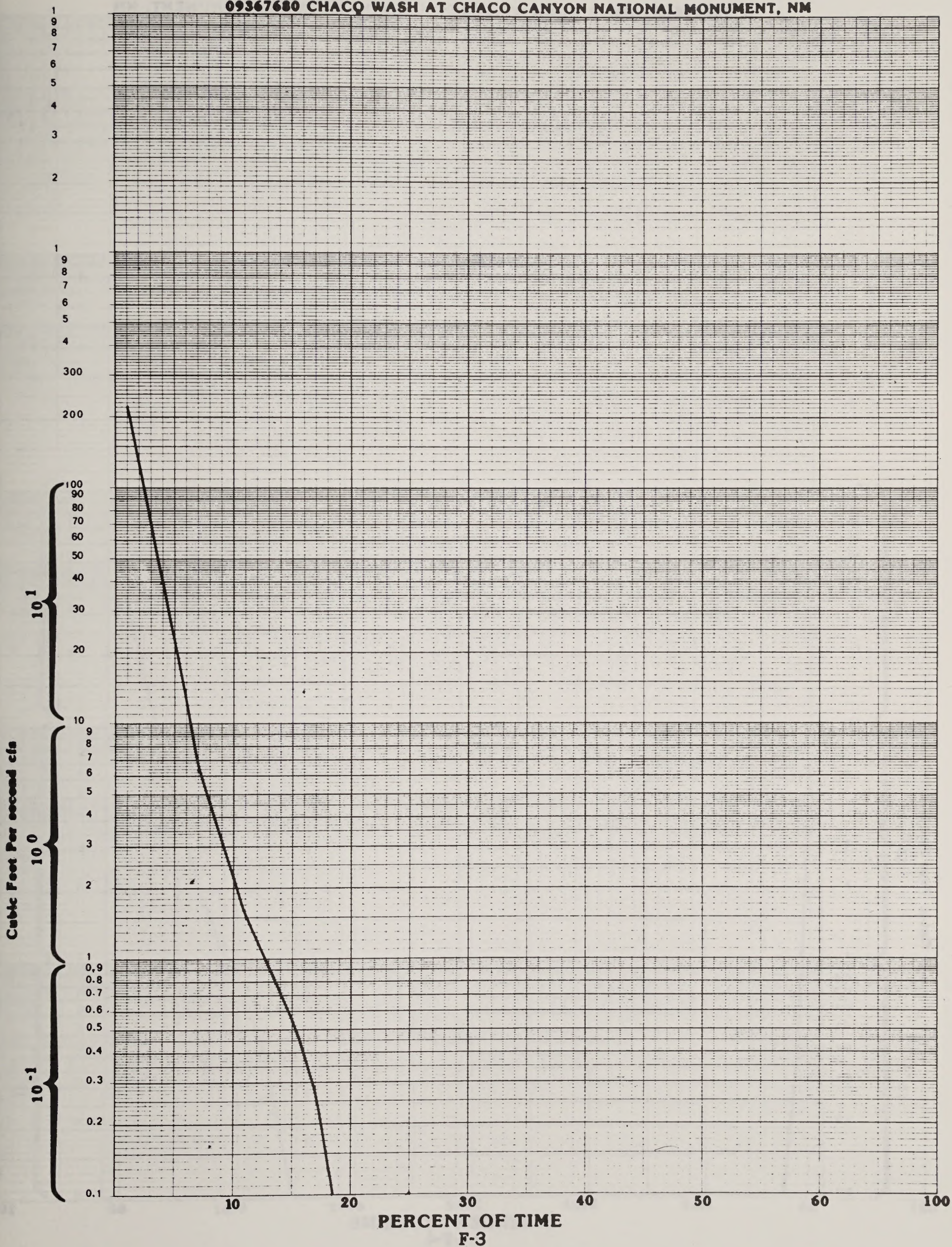


FIGURE F-4

FLOW-DURATION CURVE

09367682 GALLO WASH AT CHACO CANYON NATIONAL MONUMENT, NM

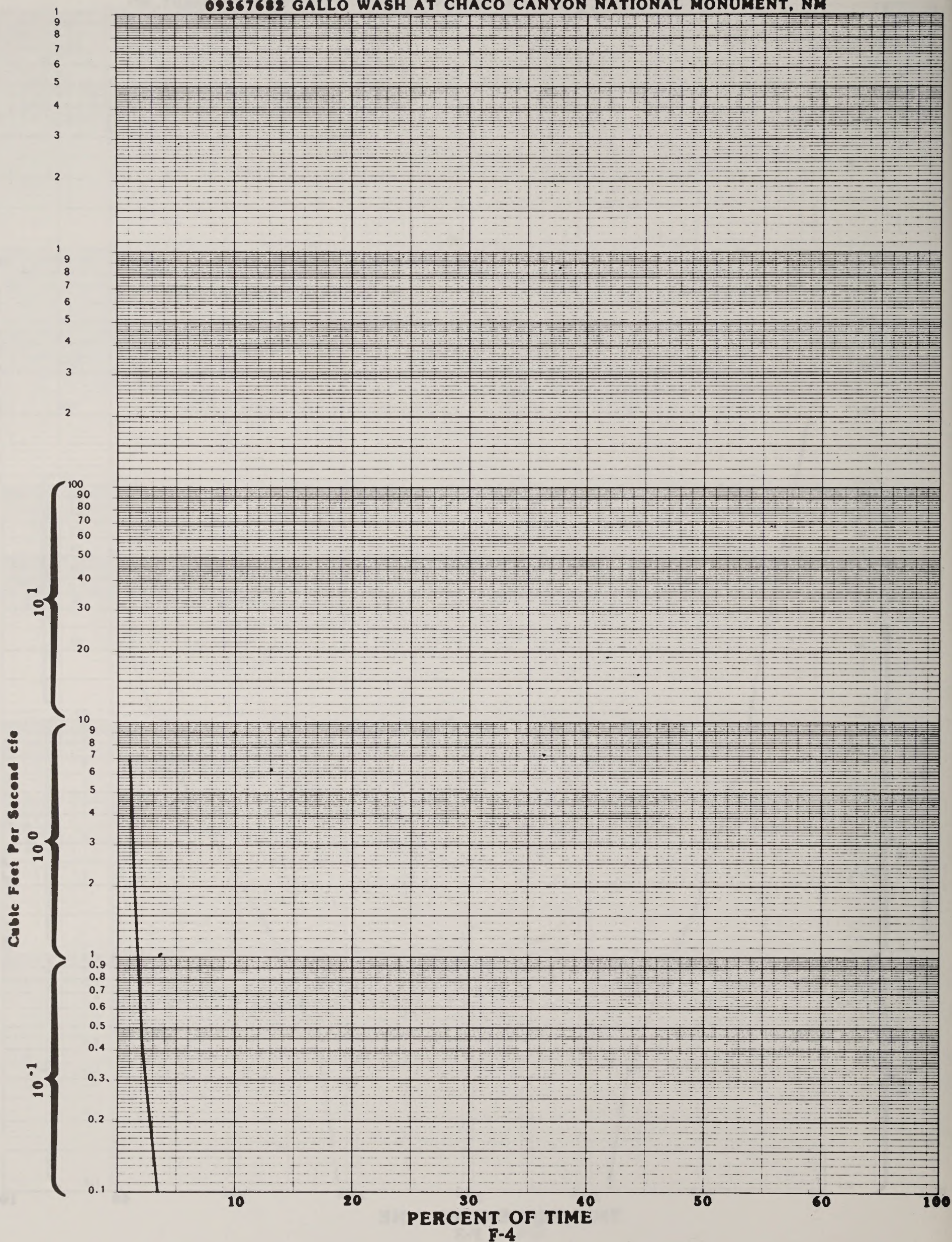


FIGURE F-5

FLOW-DURATION CURVE

09367685 AH-SHI-SLE-PAH WASH NEAR KIMBETO, NM

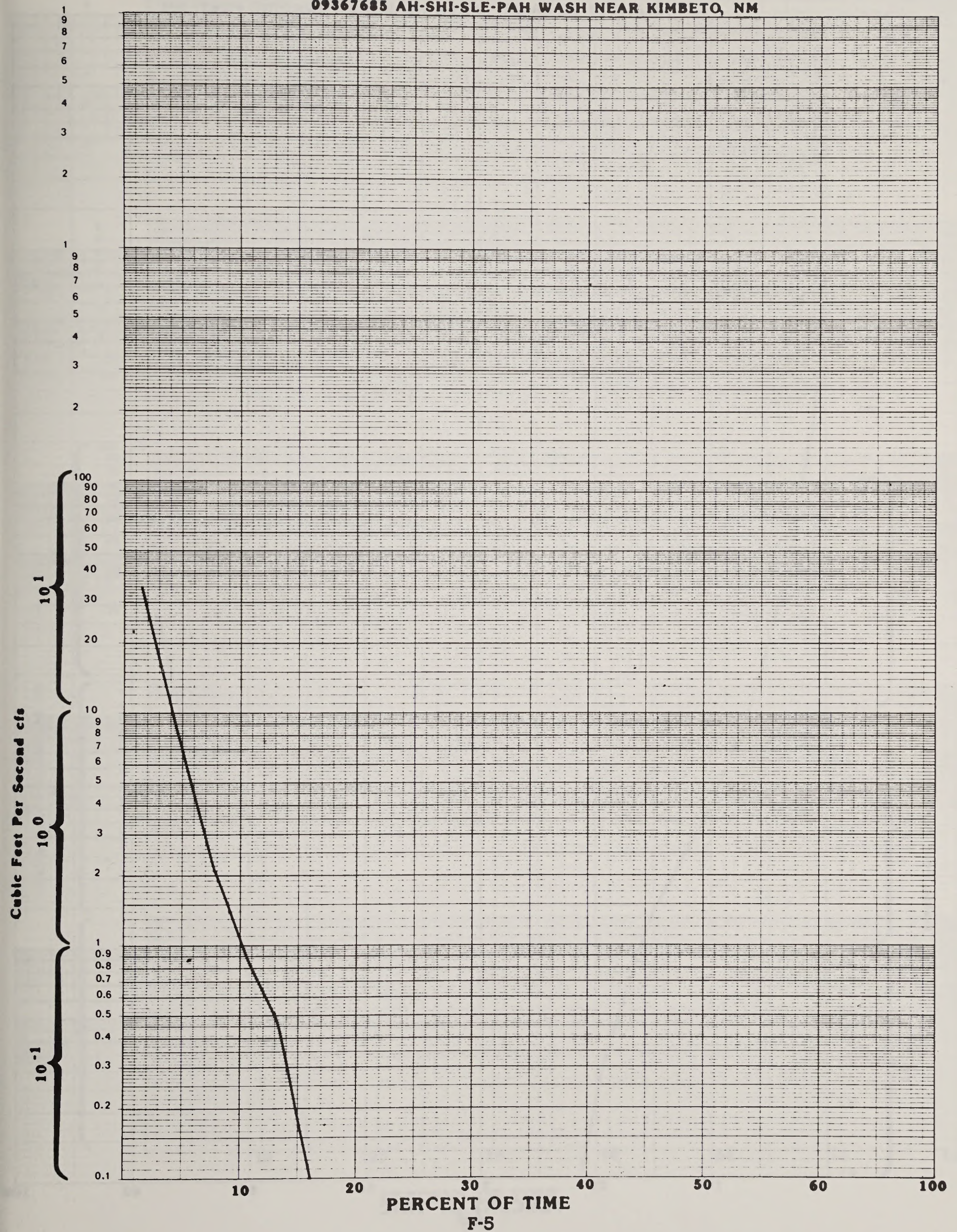


FIGURE F-6

FLOW-DURATION CURVE

09367710 DE-NA-ZEN WASH NEAR BISTI TRADING POST, NM

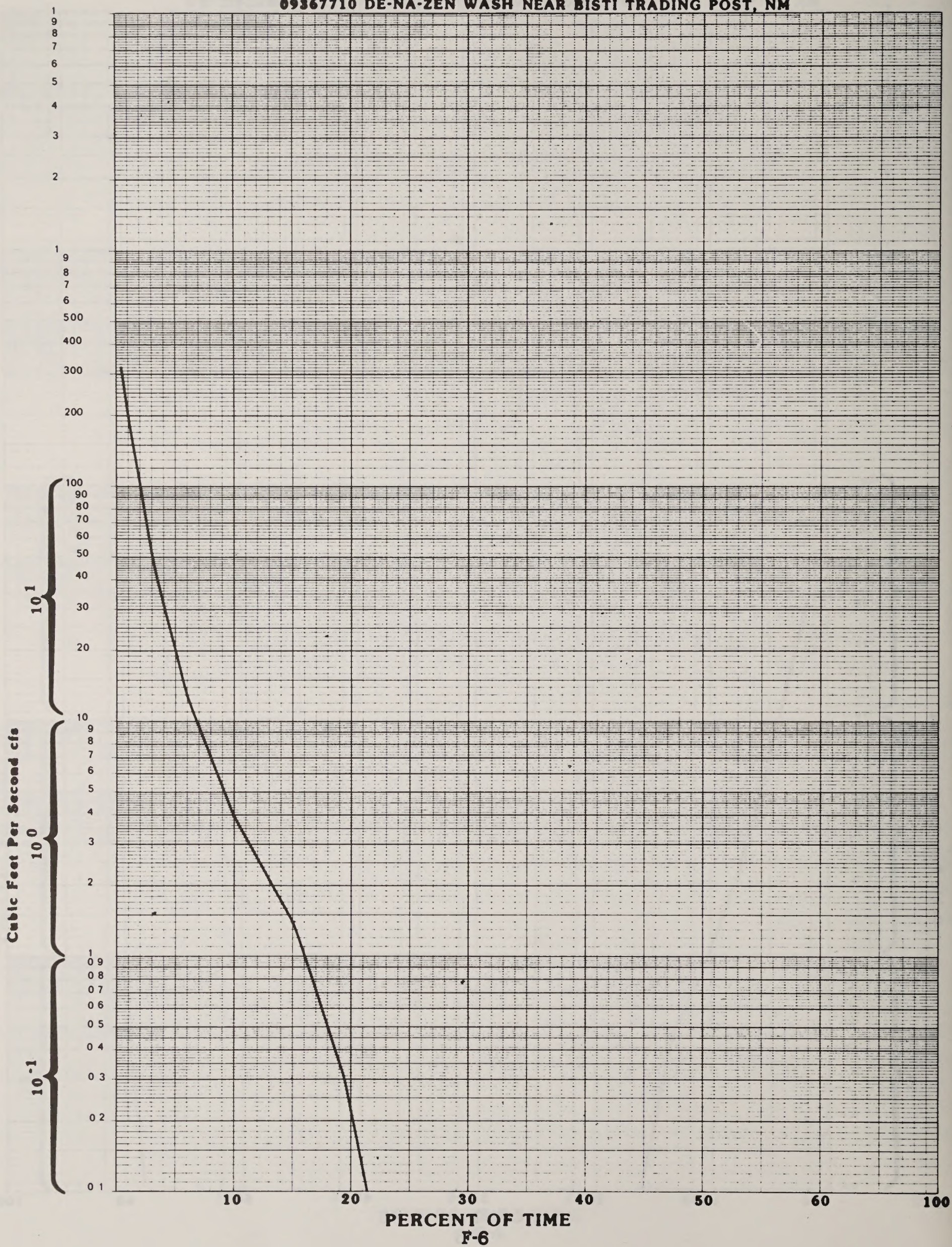
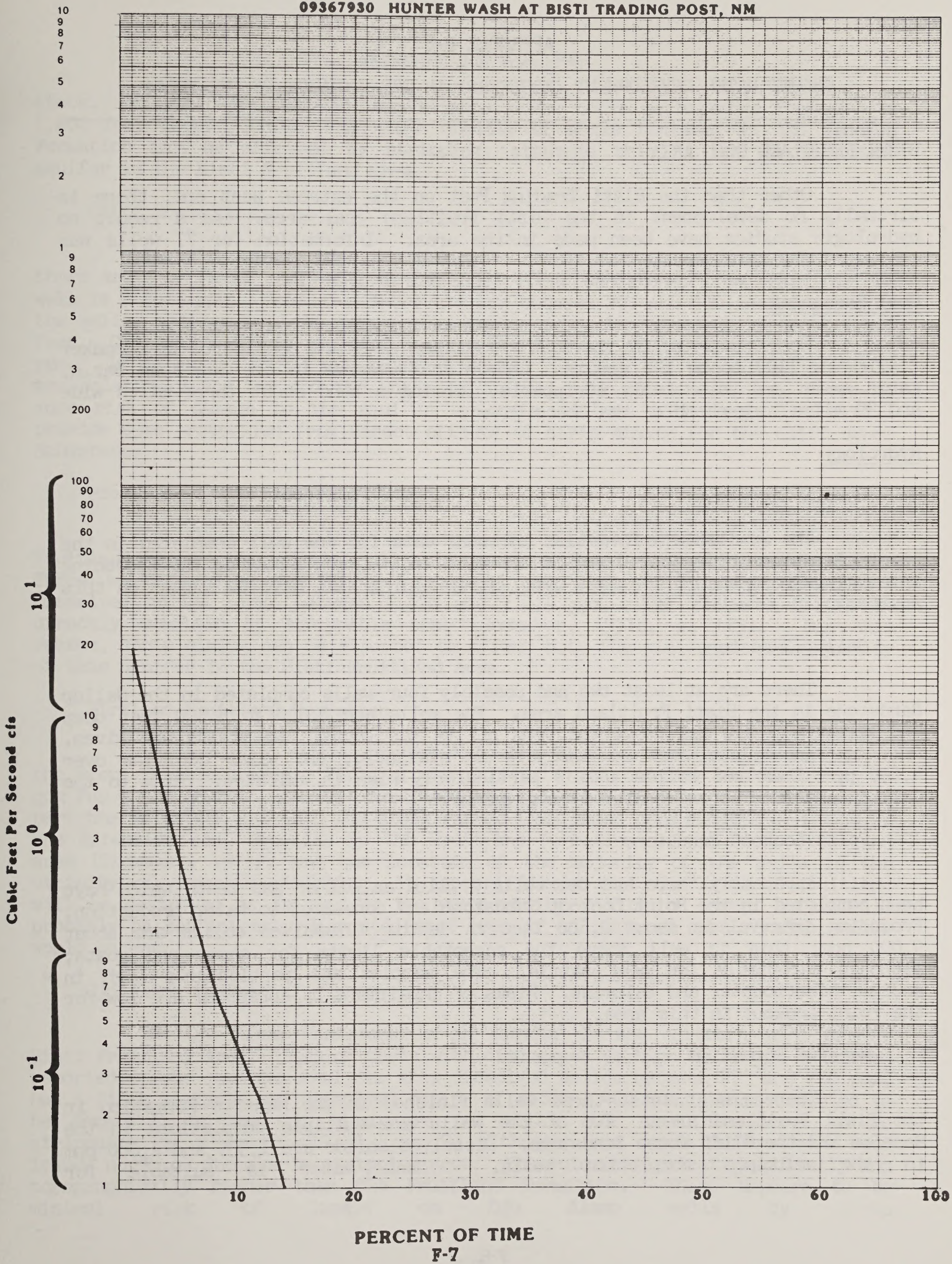


FIGURE F-7

FLOW-DURATION CURVE

09367930 HUNTER WASH AT BISTI TRADING POST, NM



APPENDIX F-8

GROUND WATER DEVELOPMENT (AQUIFERS) IN THE VICINITY OF THE PRLAs

BISTI FRUITLAND COAL AREA

Other than the Bisti Trading Post on the extreme west end, there is virtually no development in the Bisti Fruitland coal area. As a result no hydrologic studies have been made in the area. Information for 77 wells was evaluated for this report.

Coal Resources

Coal resources of the Bisti Fruitland area are considered by Shomaker (1971c. p. 110) to be the greatest undeveloped reserve in the San Juan Basin. Large areas are potentially strippable, forming a band about three miles wide and 30 miles long north of the Chaco River.

Hydrology

Dakota Sandstone

The available information includes data for one well completed in the Dakota Sandstone. Dissolved solids are about 6,000 ppm. Because the producing interval is more than 6,400 feet deep, strip mining will have no impact on this aquifer.

Gallup Sandstone

There are at least two and possibly four wells completed in the Gallup Sandstone in the Bisti Fruitland area. The wells are 4,000 to 5,500 feet deep and apparently are all converted from oil or gas tests. No yields are given. Only one incomplete chemical analysis is available; the water contains over 4,600 ppm dissolved solids and is particularly high in sulfates. Risk to the Gallup Sandstone as an aquifer is negligible.

Point Lookout Sandstone

Apparently there are two wells drilled as oil or gas tests which have been completed in the Point Lookout Sandstone and converted to water production. Producing interval is about 2,600 feet in depth. Dissolved solids are about 9,000 ppm; this is well above the acceptable limits for sheep and goats, although acceptable for beef cattle. The samples are particularly high in sodium, bicarbonate, and chloride. Risks of impairment by stripping are low for the Point Lookout in this area.

Menefee Formation

There are at least three wells finished in the Menefee Formation in the Bisti Fruitland area. Two of the wells are multiple completions in the Menefee and the Cliff House Sandstone. Dissolved solids are 1,339 and 2,080 ppm in the multiple completion wells. Such water is suitable for

APPENDIX F-8 (Cont'd)

stock. No yield information is available. The three wells range from 500 to 1,800 feet deep. Yields and water quality of wells finished in the Menefee Formation may be affected by stripping, although this is not an important aquifer in the Bisti Fruitland area.

Cliff House Sandstone

In addition to the two multiple completion wells discussed above, there are four wells completed in the Cliff House Sandstone. The yield for one well is 2 to 3 gpm. Producing intervals are between 200 and 500 feet for two of the wells; a third well is reported to have a producing interval of about 1,300 feet. Chemical analysis of water from one well shows dissolved solids of 2,946 ppm. It is suitable for all types of stock. Because the producing intervals are relatively shallow and the water is suitable for stock watering, there is some risk of damage to the aquifer by strip mining. The Lewis Shale will provide some protection from direct effects of strip mining for the Cliff House Sandstone.

Pictured Cliffs Sandstone

The Pictured Cliffs Sandstone is a minor aquifer in the Bisti Fruitland area. Approximately 11 wells are completed in the Pictured Cliffs. Three wells were tested at 4, 9, and 17 gpm with fairly large drawdowns. Dissolved solids range between 1,870 and 7,014 ppm. The Pictured Cliffs is directly overlain by strippable coal (Shomaker, 1971f, p. 113). For this reason, strip mining can be expected to affect both the yield and water quality of this aquifer in the Bisti Fruitland area.

Kirtland-Fruitland Formation

There are 11 wells completed in the Kirtland-Fruitland Formation in the Bisti Fruitland area. Yield of one well is 2 gpm; another was tested at 10 gpm for three hours. One well has dissolved solids of 838 ppm, but for the most part the wells are suitable for stock rather than human consumption. In view of the extensive coal deposits in the Fruitland Formation in the Bisti Fruitland area (Shomaker, 1971f) and the location of the majority of the wells in the vicinity of expected stripping, it appears likely that the Kirtland-Fruitland will be destroyed as an aquifer by strip mining. Flow of ground water will probably be sufficiently disrupted that even if an isolated area remains, wells would go dry.

Ojo Alamo Sandstone

The Ojo Alamo Sandstone is an aquifer in the northern part of the Bisti Fruitland area. Pumping tests with discharges as high as 18 gpm have been reported. Four chemical analyses show dissolved solids between 473 and 770 ppm, but a fifth analysis had dissolved solids of about 1,400 ppm. Wells reported to be completed in the Ojo Alamo are not within the area considered to be strippable by Shomaker (1971f, pl. 3) although some state leases have been issued north of Shomaker's stripping area. The outcrop is stratigraphically and topographically higher than the Fruitland Formation. There appears to be minimal risk of impact on Ojo Alamo wells by strip

APPENDIX F-8 (Cont'd)

mining, unless stripping occurs several miles further to the north and east than Shomaker anticipated.

Nacimiento Formation

The Nacimiento Formation is an aquifer in the northeastern portion of the Bisti Fruitland area, yielding water to seven wells in T. 24 N., Rs. 9 and 10 W. One yield of 5 gpm is reported. No chemical analyses are available, but specific conductances for five of the wells range from 1,230 to 2,000 umhos. The Nacimiento is topographically and stratigraphically higher than the area of strippable coal as defined by Shomaker (1971f, pl. 3). Risk of well impairment seems minimal.

Valley Fill

Valley fill in the Bisti Fruitland area provides water to about 18 wells. Because discharges in the arroyos are extremely flashy, yields of the wells can be expected to vary with the amount of recharge. One reported yield is "4 to 20 gpm." Most of the wells are less than 20 feet deep. Dissolved solids for three wells range from 567 to 1,470 ppm. The valley fill aquifer is downstream from the stripping area. Therefore the potential for damage to the valley fill aquifers could be significant.

Summary

The Dakota, Gallup and Point Lookout Sandstone are not important aquifers in the Bisti Fruitland area and they are deep enough so that there is little risk to the aquifers from stripping. The Menefee Formation and Cliff House Sandstone are minor aquifers with some risk of impairment. The Pictured Cliffs Sandstone is a minor aquifer which in some areas will be disrupted by strip mining. Neither the Ojo Alamo Sandstone nor the Nacimiento Formation appear to be threatened by strip mining. The Kirtland-Fruitland Formation is a minor aquifer which will be disrupted by strip mining. The valley fill aquifer with a relatively large number of wells may undergo some changes in water quality.

STAR LAKE FRUITLAND AREA

The Star Lake Fruitland area includes the town of Cuba and parts of three counties. Much of the area has been included in regional hydrological studies by Renick (1926, 1931), and Baltz and West (1967), and more specific studies by Spiegel (1957), Bushman (1957), and Baltz and others (1962). Information was evaluated for about 180 wells for this study. Most of the wells are near Cuba.

Coal Resources

Insufficient information was available in 1971 (Shomaker and Lease, 1971) to define completely the coal resources of the Star Lake Fruitland area. However, Shomaker and Lease (1971, fig. 55) did provide a map of likely strippable coal areas. Strippable coal is contained in the Fruitland Formation.

APPENDIX F-8 (Cont'd)

Hydrology

Dakota Sandstone

Information is available for only one well in the Dakota, an oil-test well. The producing interval is about 4,000 feet deep, and thus the Dakota Sandstone is in no danger of impairment by strip mining.

Gallup Sandstone, Point Lookout Sandstone, Crevasse Canyon Formation

No information is available to indicate that any wells in the Star Lake Fruitland area are completed in the Gallup or Point Lookout Sandstone or the Crevasse Canyon Formation. One oil-test well completed in the Mesaverde Group yielded water containing 38,450 ppm dissolved solids.

Menefee Formation

Several wells in T. 20 N., R. 8 W., and one well in T. 21 N., R. 8 W., are completed in the Menefee Formation. Most are also completed in the Cliff House Sandstone. Reported yields are between 4 and 20 gpm. Dissolved solids ranged from 1,368 to 2,861 ppm. Water of this chemical quality is suitable for stock. These wells are in or near the strippable area projected by Shomaker and Lease (1971, fig. 55).

Cliff House Sandstone

In addition to the multiple completion wells discussed above, there are least 20 wells finished in the Cliff House Sandstone in the Star Lake Fruitland area. Reported yields are generally less than 10 gpm, although one well was reportedly tested at 200 gpm for 25 hours. Dissolved solids range between 1,300 and 4,100 ppm. Most of these wells are located in, or near, the stripping areas projected by Shomaker and Lease (1971, fig. 55). The Cliff House outcrop is on the opposite side of the Chaco River from the strippable area and the formation will be somewhat protected by the Lewis Shale. However, several wells may be destroyed by strip mining.

Pictured Cliffs Sandstone

Fourteen wells are completed in the Pictured Cliffs Sandstone. Reported yields are 3 to 20 gpm. Six chemical analyses indicate that water quality is variable dissolved solids ranging between 306 and 4,113 ppm. Most of these wells are located in the vicinity of the strippable area, and the outcrop is located immediately downstream.

Kirtland-Fruitland Formation

Coal-bearing rocks of the Star Lake Fruitland area are unimportant as an aquifer. One spring and three wells yield water from the Kirtland or Fruitland, and four other wells may be partially completed in this formation. Only one chemical analysis is available. Dissolved solids are 2,234 ppm for that well. The spring and some of the wells may be

APPENDIX F-8 (Concluded)

destroyed by mining, but the locations of other wells upslope from the stripping areas may be affected.

Ojo Alamo Sandstone

The Ojo Alamo Sandstone is present over about half the Star Lake Fruitland area. The sandstone yields water to 54 of approximately 180 wells in the area. One well was tested at 90 gpm for one hour, but yields up to 55 gpm are more common. Most wells produce water with dissolved solids of 300 to 400 ppm. although reported dissolved solids range from 56 ppm to 4,010 ppm.

The Ojo Alamo Sandstone is an excellent aquifer for this area. Fortunately it is both topographically and stratigraphically higher than the strippable coal and is under very limited risk of impairment by strip mining.

Nacimiento Formation

The Nacimiento Formation yields water to at least four wells and a spring in the Star Lake Fruitland area. No information on yields or of total dissolved solids is available. Specific conductance is 770 umhos for water from the Nacimiento in a multiple completion well. This aquifer will not be affected by strip mining.

San Juan Formation

The San Juan Formation yields water to at least 38 wells where it is present in the Star Lake Fruitland area. Yields generally are less than 5 gpm, although a few wells reportedly produce 30 to 50 gpm. Chemical analyses show total dissolved solids less than 800 ppm, but water from the formation is usually very high in iron. Strip mining will have no impact on this aquifer.

Valley Fill

Valley fill is an important aquifer in the Star Lake Fruitland area where it yields water to at least 67 wells. Yields are usually less than 5 gpm, although two wells reportedly have yields of 20 gpm. Dissolved solids range from 129 to 3,288 ppm. Generally speaking, valley fill wells upslope of strip mining will not be influenced, but those within the outcrop and downslope may be.

Summary

The Dakota, Gallup, and Point Lookout Sandstones and Crevasse Canyon Formation are not used as aquifers in the Star Lake Fruitland area. The Ojo Alamo Sandstone and San Juan Formation are important aquifers which do not appear to be in danger of impairment by strip mining. Some wells in the Menefee Formation, Valley Fill, and Pictured Cliffs and Cliff House Sandstones are in danger of impairment or destruction. The Kirtland- Fruitland Formation will be disrupted as an aquifer in some areas.

Source: Geohydrology Associates, Inc. 1980.

APPENDIX F-9

WATER QUALITY CRITERIA FOR LIVESTOCK AND WILDLIFE USE

Parameter	Animal Watering
Salinity	TDS ^{a/} of less than 3,000 mg/l ^{b/} very satisfactory for all livestock and poultry TDS between 5,000 to 7,000 mg/l suitable for cattle, sheep, swine and horses, but not for lactating animals or poultry TDS above 10,000 mg/l not recommended for use
Chloride	1,500 mg/l or less suitable for all livestock and poultry
Fluoride	2.0 mg/l or less suitable for all livestock and poultry
Sulfate	1,000 mg/l or less suitable for most livestock 2,000 mg/l and above can be detrimental to cattle
Nitrate	100 mg/l or less suitable for livestock and poultry
Arsenic	0.2 mg/l or less suitable for livestock and poultry
Boron	5 mg/l or less suitable for livestock and poultry
Cadmium	0.05 mg/l or less suitable for livestock and poultry
Iron	No criterion, toxic only at abnormally high levels
Lead	0.1 mg/l or less suitable for livestock and poultry
Manganese	No criterion, toxic only at abnormally high levels
Mercury	0.01 mg/l or less suitable for livestock and poultry
Selenium	0.05 mg/l or less suitable for livestock and poultry
Gross alpha radiation	15 pCi/l ^{c/} (EPA Drinking Water Standard)
Gross beta radiation	50 pCi/l (EPA Drinking Water Standard)

Sources: Federal Water Pollution Control Administration 1968.
National Academy of Sciences and National Academy of Engineering 1972.

Notes: ^{a/} TDS=Total Dissolved Solids
^{b/} mg/l=milligrams per liter
^{c/} pCi/l=picoCuries per liter

WATER QUALITY CRITERIA FOR IRRIGATION

Parameter

Irrigation Water Supply

Salinity	TDS <u>a/</u> of less than 1,000 mg/l <u>b/</u> or less suitable for many crops; TDS of 2,000 mg/l or more not suitable for most crops; TDS of 2,000 to 5,000 mg/l useful only for tolerant plants on permeable soils with careful management
Sodium	Sodium absorption ratios (SAR) greater than 4 can be detrimental to sodium-sensitive crops; SAR values of 8 to 18 generally acceptable for most crops.
Chloride	700 mg/l or less acceptable for many crops 100 mg/l harmful to certain fruit plants TDS effects normally deter crop growth before chlorides reach detrimental levels
Fluoride	1.0 mg/l or less suitable for continuous use on all soils
Sulfate	600 mg/l or less are acceptable for most crops 1,000 mg/l or more are unsuitable for most crops
Nitrate	No criterion
Arsenic	0.10 mg/l or less suitable for continuous use on all soils
Boron	0.75 mg/l or less suitable for continuous use on sensitive crops on all soils 1.0 mg/l or less suitable for semitolerant crops; 2.0 mg/l or less suitable for tolerant crops
Cadmium	0.01 mg/l or less suitable for continuous use on all soils
Iron	5.0 mg/l or less suitable for continuous use on all soils
Lead	5.0 mg/l or less suitable for continuous use on all soils
Manganese	0.20 mg/l or less suitable for continuous use on all soils
Mercury	No criterion
Selenium	0.02 mg/l or less suitable for continuous use on all soils
Gross alpha radiation	15 pCi/l <u>c/</u> (EPA drinking water standard)
Gross beta radiation	50 pCi/l (EPA drinking water standard)

Sources: Federal Water Pollution Control Administration 1968.
National Academy of Sciences and National Academy of Engineering 1972.

Notes: a/ TDS=Total Dissolved Solids
b/ mg/l=milligrams per liter
c/ pCi/l=picoCuries per liter

WATER QUALITY CRITERIA FOR HUMAN CONSUMPTION

Parameter	Maximum Concentration mg/l (ppm)a/	Parameter	Maximum Concentration mg/l (ppm)a/
<u>Primary Parameters, (Cont'd)</u>			
Coliform bacteria	4 organisms/100 ml in more than one sample when less than 20 samples are examined monthly		
Gross alpha radiation	15 pCi/lb/		
Gross beta radiation	50 pCi/lb/		
<u>Secondary Parameters</u>			
Alkalinity	30-500		
Bicarbonate	700		
Calcium	75-200		
Carbonate	350		
Chloride	250		
Color	15 Units		
Odor	3 Units		
Conductance	1,000 Micromhos		
Hardness	250		
Iron	0.3		
Magnesium	125		
Manganese	0.05		
pH	6.0-8.5		
Potassium	1,000		
Sodium	200		
Sulfate	250		
Turbidity (field test)	1-5 Test Units		
<u>Primary Parameters</u>			
Arsenic	0.05		
Barium	1.00		
Cadmium	0.010		
Chromium	0.05		
Lead	0.05		
Mercury	0.002		
Selenium	0.01		
Silver	0.05		
Nitrate (as N)	10.0		
Endrin	0.0002		
Lindane	0.004		
Methoxychlor	0.1		
Toxaphene	0.006		
2, 4-D	0.1		
2, 4, 5-TP (Silvex)	0.01		
<u>Fluoride</u>			
Annual Avg. of Max. Air Temp.			
Degrees Fahrenheit	Degrees Celsius		
53.7 & below	12.0 & below		
53.8 to 56.3	12.1 to 14.6		
58.4 to 63.8	14.7 to 17.6		
63.9 to 70.6	17.7 to 21.4		
70.7 to 79.2	21.5 to 26.2		
79.3 to 90.5	26.3 to 32.5		

Source: Environmental Protection Agency 1976.

Notes: a/ $\text{mg/l (ppm)} = \text{milligrams per liter (parts per million)}$
b/ $\text{pCi/l} = \text{picoCuries per liter}$

APPENDIX F-12

APPROXIMATE FLOODPLAIN ACREAGES
ON THE PRLAs

PRLA Number	Channel	Acreage
NM-585	Papers Wash Tributary	50
	Salazar Wash	57
	Total	107
NM-3753	Tributary South of De-na-zin Wash	115
	Coal Creek	75
	Total	190
NM-3755	Tsaya Canyon Tributary	82
	Ah-shi-sle-pah Wash	90
	Ah-shi-sle-pah Tributary	42
	Total	214
NM-3834	Willow Wash	132
	Alamo Wash	138
	Total	270
NM-3835	Tributary North of De-na-zin Wash	35
	De-na-zin Wash	70
	Tributary South of De-na-zin Wash	125
	Coal Creek	15
	Total	245
NM-3836	Coal Creek Tributary	110
	Coal Creek	110
	Tsaya Canyon	75
	Tributary South of De-na-zin Wash	160
	Total	455
NM-3837	Tsaya Canyon	285
	Tsaya Canyon Tributary	205
	Total	490
NM-3838	De-na-zin Wash	50
	Alamo Wash	180
	Willow Wash	40
	Total	270
NM-3918	Betonneie Tsosie Wash	315
	Betonneie Tsosie Tributary	80
	Escavada Wash Tributary	65
	Total	460

APPENDIX F-12 (concluded)

PRLA Number	Channel	Acreage
NM-3919	Kimbeto Wash	110
	Ah-shi-sle-pah Wash	60
	Ah-shi-sle-pah Tributary	10
	Total	<u>180</u>
NM-6801	Hunter Wash	175
	Willow Wash	20
	Total	<u>195</u>
NM-6803	Coal Creek Tributary	70
	Tsaya Canyon	45
	Total	<u>115</u>
NM-6804	Kimbeto Wash	30
NM-8128	Canada Alamita	125
	Canada Alamita Tributary	215
	Total	<u>340</u>
NM-8129	Escavada Wash	225
	Escavada Wash Tributary	50
	Total	<u>275</u>
NM-8715	Canada Alamita	30
	Canada Corrales	140
	Total	<u>170</u>
NM-8745	Kimbeto Wash	55
NM-9764	Betonnies Tsosie Wash	15
NM-11670	Gallo Wash	80

Source: Acreages computed with dot grid, using Flood Hazard Boundary Maps (U.S. Dept. of Housing and Urban Development, Federal Insurance Administration 1977 and 1978).

appendix G

LIVESTOCK GRAZING

APPENDIX G-1

ACREAGE INVOLVED IN PRLAS BY ALLOTMENT

Allotment Number	Allotment Name	PRLA Number	Acres Involved	Percentage of Total Allotment	Allotment Number	Allotment Name	PRLA Number	Acres Involved	Percentage of Total Allotment
6008	Bisti Community	6801 3838 11916 3834	2,550 480 2,720 280 Total 6,030	24	6013	Kimbeto Community (Cont'd) No. 5	3755 3918	480 320 800	
							Subtotal		
6009	Eli Smith	6802 3752	320 800 Total 1,120	41		No. 6	3918 3919 8745 9764 6804	1,917 1,700 520 240 60 4,437	
6010	Black Lake (Paragon Resources)	3834 6803 6802 6801 6804 3837 3836 7235 3835 3838 3919 3755 3752 3753	4,524 3,841 20 10 640 5,120 5,110 160 4,500 4,307 1,818 1,148 160 2,791 Total 34,149				Total 10,859		11
					6015	Counselor Community	8715	640	<1
					6016	Lake Valley Community	3755	960	1
					6017	Chaco Canyon	8128 11670	760 1,119 Total 1,879	2
					6018	Pueblo Pintado Community	8715 8130 8128	801 2,133 3,739 Total 6,673	10
6011	Otis Community	6803	1,280	3	6019	M. Tanner Chaco Energy Co.	8715	480	25
6012	Tsaya (AMP)	3752 3753 3754	2,800 160 3,075 Total 6,035	28	6023	Star Lake Community	8717 585	600 2,811 Total 3,411	3
6013	Kimbeto Community No. 1 No. 3 No. 4	6804 8129 8129 3919 3918	902 560 960 960 2,240 Subtotal 4,160		NIIP		6801 11916	1,834 160 Total 1,994	N/A
							GRAND TOTAL	75,510	

Source: USDI, BLM 1980.

APPENDIX G-2

VEGETATIVE TYPES (AUMs) ON PRLAs BY ALLOTMENT

Vegetative Types a/																												
Allot. No.	PRLA No.	L-S		LB-S		S-S		DS-GS		SS-G		S-PJ		SS-PJ		SF-H		Ba		Du		RW		TOTAL				
		Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs			
6008	3834																	280	15					280	15			
	3838	60	6															420	23					480	29			
	6081																	2,550	137					2,550	137			
	11916							35	5									2,685	144					2,720	149			
	Total	60	6			35	5	35	5									5,935	319					6,030	330			
6009	3752							595	77									205	11					800	88			
	6802	77	8															243	13					320	21			
	Total	77	8			595	77	595	77									448	24					1,120	109			
6010	3834	242	25			423	55											3,859	207					4,524	287			
	6803	1,143	123	82		567	74											1,200	64					3,841	343			
	6802	10	1															10	1					20	2			
	6801																	10	1					10	1			
	6804																	640	34					640	34			
	3837	517	56	1,193	104		425											145	8					5,120	593			
	3836	397	43	2,507	220		173											876	47					5,110	483			
	7235					160	21																	160	21			
	3835			1,918	168		252			69	4							575	31					4,500	455			
	3838	329	34			569	74											3,409	183					4,307	291			
	3919	330	35															1,488	80					1,818	115			
	3755	61	7															424	23					1,148	116			
	3752					660	86																	160	21			
	3753					160	21																			226		
	Total	3,029	324	7,163	628	9,742	1,268			491	30							1,016	55					2,791	226			
										563	34							13,652	734					34,149	2,988			
6011	6803	130	14	985	86	85	11											80	4					1,280	115			
	Total	130	14	985	86	85	11											80	4					1,280	115			
6012	3752					1,012	132			609	37							1,179	63					2,800	232			
	3753				9	20	3			40	2												160	14				
	3754	132	14	100		500	65			1,872	114							571	31					3,075	224			
	Total	132	14	100	9	1,532	200			2,521	153							1,750	94					6,035	470			
6013	6804	264	28	188	16					100	6							393	21					17	1	962	72	
	8129	117	13	123	11		109											366	20					63	2	1,520	155	
	3919	361	38	18	2		55			105	6							1,534	82					81	3	2,660	200	
	3918	1,777	189	248	23		91			932	57			149	10			396	21					249	9	4,477	401	
	3755	70	8															410	22							480	30	
	8745	136	15	95	9					88	5													105	4	520	43	
	9764	103	11	115	10														5	1				17	1	240	23	
	Total	2,828	302	787	71	1,991	255			1,225	74			149	10			3,099	166					532	20	10,859	924	

APPENDIX G-2 (concluded)

		Vegetative Types a/																							
Allot. No.	PRLA No.	L-S		LB-S		S-S		DS-GS		SS-G		S-PJ		SS-PJ		SF-H		Ba		Du		RW		Total	
		Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs	Acres	AUMs
6015	8715 Total	310 310	27 27			165 14										102 102	10 10	63 63	3 3					640 54	
6016	3755 Total	80 80	9 9					865 865	112 112									15 15	1 1					960 122	122 122
6017	8128 11670 Total	125 370 495	13 40 53	422 422	38 38			8 639 647	1 83 84	110 110	7 7							205 205	11 11					760 1,119 1,879	63 130 193
6018	8715 8130 8128 Total	261 375 722 1,358	23 33 77 133	164 109 945 1,218	15 10 86 111	240 110 350	20 9	52 1,173 1,693 2,918	7 150 217 374					227 227	15 15	84 366 9 459	8 30 0 38	143 143	8 8					801 2,133 3,739 6,673	73 232 403 708
6019	8715 Total	33 33	3 3			189 189	16 16									258 258	26 26							480 45	45 45
6023	8717 585 Total	135 103 238	12 9 21	1 653 654	0 59 59	365 655 1,020	29 52 81			452 452	26 26	7 7	0 0			58 265 323	5 21 26	41 676 717	2 36 38					600 2,811 3,411	48 203 251
NIIP	11916 6801 Total							1,603 1,603	208 208									160 231 391	9 12 21					160 1,834 1,994	9 220 229
GRAND TOTAL		8,770	941	11,329	1,002	1,724	140	20,013	2,594	4,871	294	7	0	376	25	1,142	100	26,498	1,423	248	26	532	20	75,510	6,538

Source: USDI, BLM 1980.

Note: ^{a/} L-S = Loamy-Sagebrush; LB-S = Loamy Bottom-Sagebrush; S-S = Sandy-Sagebrush; DS-GS = Deep Sand-Grassland - Saltbrush;
 SS-G = Sodic Slopes-Grassland; S-PJ = Shallow - Pinyon-Juniper; SS-PJ = Sandy to Shallow - Pinyon-Juniper; SF-H = Salt Flats - Halophytic;
 Ba = Badlands; Du = Dunelands; Rw = Riverwash - Wetlands.

appendix H

PALEONTOLOGY

Appendix H

DEFINITIONS FOR IMPORTANCE VALUES ASSIGNED TO FOSSIL OCCURRENCES (FROM KUES, ET AL., 1977)

Class I CRITICAL/MITIGATION OR PROTECTION ESSENTIAL

This class includes any locality containing fossils that, by their rarity or exceptionally good or complete preservation, will add considerably to knowledge of the paleobiology, morphology, stratigraphic or geographic distribution, or paleoenvironment of the fossil organisms. Such localities often contain a great abundance of ordinarily rare taxa, fossils new to science, parts of fossil organisms that have not been known previously and/or unusual or unique in situ assemblages of fossils. Mitigation of these sites is essential because of the great amount of new paleontological information they contain. Depending on the size and type of deposit, mitigation may include total protection, or salvage through large scale surface collecting, excavation or bulk sediment sampling for screening purposes; or salvage may be limited to a statistically valid sample of all forms present.

Class II HIGHLY IMPORTANT/MITIGATION STRONGLY RECOMMENDED

These are localities containing fossil materials that significantly extend our knowledge of the morphology, paleobiology, stratigraphic or geographic distribution, or paleoecology of a species or assemblage. Highly Important sites generally contain numerous surface deposits that suggest more extensive or important remains would be revealed by intensive collecting and excavation. In some cases, beautifully preserved single specimens, such as a complete dinosaur bone or turtle carapace would also be considered Highly Important. High surface concentrations of small fossils, such as fish scales, reptile teeth, or freshwater molluscs, which suggest that bulk screening would produce hundreds or thousands of additional specimens are likewise Highly Important. Mitigation is strongly recommended for these sites and would consist of salvage similar to that recommended for the Critical localities. In most cases valid statistical samples would probably suffice but for rare species as much material as possible should be collected.

Class III IMPORTANT/MITIGATION RECOMMENDED

Important localities contain fossil materials that are relatively plentiful, common near the locality and elsewhere, and provide useful information for stratigraphic, geographic or variability studies. Single well preserved skeletal parts that are known from other specimens but worthy of examination or display are also in this category. Mitigation would generally be limited to a statistically valid sample of the fossils at the locality; large scale excavation or screening would rarely be needed.

Class IV INSIGNIFICANT/MITIGATION OPTIONAL

These localities contain fossils that are very poorly preserved, fragmented or undiagnostic and that are common elsewhere. Such localities provide minimal new information and show no indication that additional collecting, excavation or screening would provide additional material of value. Mitigation is optional and would be limited to sites that are near more important deposits.

appendix I

SOCIAL & ECONOMIC CONDITIONS

Country	Population, 1950		Population, 1955		Population, 1960	
	Number	% of Total	Number	% of Total	Number	% of Total
Belgium	10,175	65.80	11,500	71.05	13,100	77.10
France	21,774	28.34	24,200	31.34	26,500	32.48
Germany	18,175	26.12	20,200	26.82	22,500	28.88
Italy	11,175	14.25	12,800	16.13	14,500	18.05

Source: U.S. Department of Commerce, Bureau of Economic Analysis, 1955.

APPENDIX I-1

NEW MEXICO POPULATION BY COUNTY BY DECADE

County	1950	1960	1970	1980
McKinley	27,451	37,500	43,200	56,210
Sandoval	12,438	14,200	17,492	33,994
San Juan	18,292	53,300	52,517	80,906
Valencia	<u>22,500</u>	<u>39,200</u>	<u>40,567</u>	<u>61,334</u>
Four-County Totals	80,681	144,200	153,784	232,504
New Mexico Totals	681,187	945,000	1,017,055	1,295,474

Source: U.S. Department of Commerce, Bureau of the Census 1953, 1962, 1972, and 1981.

APPENDIX I-2

ETHNIC POPULATION BY COUNTY, 1980

County	American Indian		Hispanic		White	
	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total
McKinley	36,155	65.80	7,500	13.65	6,571	11.96
Sandoval	9,499	29.30	9,580	27.53	10,941	31.44
San Juan	26,777	31.12	9,551	11.82	39,321	48.64
Valencia	8,368	13.75	26,857	44.13	16,477	27.08

Source: U.S. Department of Commerce, Bureau of the Census 1981.

APPENDIX I-3

DEMOGRAPHIC DATA

Item	Unit	County				Four-County Totals	New Mexico Totals
		McKinley	Sandoval	San Juan	Valencia		
Average annual population change, 1950-1960	Percent	3.53	1.45	19.13	7.38	7.82	3.96
1960-1970	Percent	1.61	2.32	-.15	.38	.69	.69
1970-1980	Percent	2.72	9.88	5.40	4.99	5.05	2.78
American Indian population, 1980 as percent of county total, 1980	Number Percent	36,155 65.80	9,499 29.30	26,777 33.10	8,368 13.80	80,799 34.90	104,777 8.10
Hispanic population, 1980 as percent of county total, 1980	Number Percent	7,500 13.60	9,580 27.50	9,551 11.80	26,857 44.10	53,488 23.10	476,089 36.60
White population, 1980 as percent of county total, 1980	Number Percent	6,571 12.00	10,941 31.40	39,321 48.60	16,459 27.00	73,310 31.70	500,376 38.50
Portion of county population considered rural, 1970	Percent	57.10	100.00	51.80	66.50	62.65	31.10
Indian pueblos and reservations located or partially located within the county	Number	2	13	2	7		
Population 65 years old and over, 1970	Percent	4.40	7.10	4.90	5.60	na ^{c/}	7.00 ^{a/}
1975	Percent	4.40	7.60	5.30	6.10	na	7.90
1978	Percent	4.40	7.20	5.10	5.60	na	8.60 ^{b/}
Births per 1,000 population, 1978	Number	29.00	22.60	25.30	24.60	na	19.70 ^{d/}
County population as portion of state total	Percent	4.22	2.68	6.22	4.68	17.80	100.00
Total population, 1980	Number	54,950	34,799	80,833	60,853	231,435	1,299,968

Source: U.S. Department of Commerce, Bureau of the Census 1953, 1962, 1972, 1980.

Notes: ^{a/} Percentage of national population in this category was 7.0.^{b/} Percentage of national population in this category was 8.6.^{c/} na = not available.^{d/} National birth rate per 1,000 population was 15.3.

APPENDIX I-4

AVERAGE ANNUAL PERCENT CHANGES IN CITY POPULATION BY DECADE

City	1940-1950	1950-1960	1960-1970	1970-1980
Aztec	1.71	36.75	-1.89	6.49
Bloomfield	na	na	2.18	20.70
Cuba	na	na	na	4.57
Farmington	6.83	55.00	0.76	4.19
Gallup	2.97	5.43	0.35	2.47
Grants	na	35.64	-1.47	3.27
Milan	na	na	-1.78	6.98

Sources: U.S. Department of Commerce, Bureau of the Census 1953, 1962, 1972, and 1981.

Note: na = not available.

APPENDIX I-5

PROJECTED POPULATION CHANGE, 1980-Year 2000

County	1980 Population ^{1/}	1990 Projected ^{2/}	Average Annual Percent Change 1980-1990	Year 2000 Projected ^{2/}	Average Annual Percent Change 1990-Year 2000
McKinley	56,210	83,900	5.46	104,000	2.40
Sandoval	33,994	39,500	1.66	50,300	2.73
San Juan	80,966	110,800	3.71	141,800	2.80
Valencia	61,334	73,100	1.92	90,300	2.35
New Mexico	1,295,474	1,539,000	1.93	1,780,900	1.57

Sources: ^{1/} U.S. Department of Commerce, Bureau of the Census 1981.
^{2/} University of New Mexico, Bureau of Business and Economic Research 1979.

I-4

APPENDIX I-6

POPULATION AND POPULATION PROJECTIONS, 1980-Year 2000

City/Village	1980 ^{1/}	1990 ^{2/}	Year 2000 ^{2/}	Average Annual Percent Rate of Change 1980-1990	Average Annual Percent Rate of Change 1990-Year 2000
Aztec	5,531	9,900	12,600	7.90	2.73
Bloomfield	4,835	4,800	6,200	na ^{a/}	na
Crownpoint	1,134	4,100	5,000	26.16	2.20
Cuba	605	1,600	2,000	16.45	2.50
Farmington	31,181	53,700	68,700	7.22	2.79
Gallup	18,206	36,400	45,100	9.99	2.39
Grants/Milan	15,409	20,300	25,100	3.17	2.36

Sources: ^{1/} U.S. Department of Commerce, Bureau of the Census 1980.
^{2/} University of New Mexico, Bureau of Business and Economic Research 1979.

Note: ^{a/} na = not available.

APPENDIX I-7

ECONOMIC AND SOCIAL FACTORS DATA
(in thousands of dollars)

Personal Income by Source	McKinley		Sandoval		San Juan		Valencia		Four-County Total		New Mexico	
	Dollars	Percent	Dollars	Percent	Dollars	Percent	Dollars	Percent	Dollars	Percent	Dollars	Percent
Farm (1976)	263	.1	3,289	8.2	766	.3	5,742	5.0	10,060	1.6	174,705	3.7
Agriculture Services, Forestry, Fisheries, and Others	135	.1	389	1.0	207	.1	245	.2	976	.2	13,064	.3
Mining	66,870	31.2	951	2.4	40,903	15.1	33,010	28.7	141,734	22.1	373,466	8.0
Construction	13,239	6.2	3,464	8.6	57,522	21.2	7,311	6.4	81,536	12.7	349,128	7.5
Manufacturing	11,039	5.1	6,915	17.2	11,215	4.1	2,590	2.3	31,759	5.0	320,062	6.8
Transportation and Public Utilities	15,594	7.3	1,966	4.9	45,510	16.8	15,121	13.1	78,191	12.2	367,298	7.8
Wholesale trade	7,447	3.5	642	1.6	11,555	4.3	2,732	2.4	22,376	3.5	222,267	4.7
Retail trade	27,732	12.9	2,962	7.4	30,479	11.3	13,842	12.0	75,015	11.7	555,369	11.9
Finance, Insurance and Real Estate	3,475	1.6	2,782	6.9	6,720	2.5	4,034	3.5	17,011	2.7	177,742	3.8
Services	13,801	6.4	6,287	15.7	24,240	9.0	10,169	8.8	54,507	8.5	756,102	16.2
Government and Government Enterprises	54,867	25.6	10,451	26.1	41,644	15.4	20,193	17.6	127,155	19.9	1,371,104	29.3
TOTALS	214,462	100.0	40,108	100.0	270,761	100.0	114,989	100.0	640,320	100.0	4,680,307	100.0

Source: University of New Mexico, Bureau of Business and Economic Research 1980a.

APPENDIX I-8

PRIVATE EMPLOYMENT BY SECTOR, 1979

County	Agriculture	Mining	Construction	Manufacturing	Trans., Comm. & Utilities ^{a/}	Wholesale Trade	Retail Trade	Fire	Services	Non- Classified	Totals All Industries
McKinley	24	21,985	4,292	4,188	2,434	1,840	14,490	1,572	6,588	34	57,451
Sandoval	547	62	2,568	3,335	628	358	1,626	1,099	1,715	2	11,939
San Juan	144	13,226	16,877	6,458	14,077	4,034	18,838	3,304	21,779	12	98,768
Valencia	306	11,527	5,024	1,376	1,925	1,178	9,604	1,976	4,462	3	37,383
Four-County Totals	1,021	46,800	28,761	15,357	19,064	7,410	44,558	7,951	34,544	51	205,541
Average	255	11,700	7,190	3,839	4,766	1,852	11,139	1,988	8,636	13	51,385
Percent of Total	.5	22.8	14.0	7.5	9.3	3.6	21.7	3.9	16.8	>.1	100.0
New Mexico Totals	21,728	108,246	142,349	139,152	100,154	85,702	331,191	82,410	321,771	378	1,333,080
Average	5,432	27,061	35,587	34,788	25,038	21,425	82,798	20,602	80,443	94	333,270
Percent of Total	1.6	8.1	10.7	10.4	7.5	6.4	24.8	6.2	24.1	>.1	100.0

Source: New Mexico Employment Security Department 1970-1980.

Note: ^{a/} Transportation, Communications, and Utilities.

APPENDIX I-9

ANNUAL AVERAGE UNEMPLOYMENT RATE, 1970-80

County	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
McKinley	8.5	8.5	7.9	7.7	7.2	7.4	7.6	7.0	5.9	7.3	8.2
San Juan	11.7	11.0	11.0	10.7	10.7	12.2	10.3	7.5	6.4	8.1	7.8
Valencia	6.8	7.8	7.4	8.8	8.8	9.6	8.8	7.4	5.6	6.7	8.7
New Mexico	7.7	8.2	7.5	7.4	8.2	10.0	9.1	7.8	5.8	6.6	7.4

Source: New Mexico Employment Security Department, Employment Services Division, Research and Statistics Section 1970-1980.

APPENDIX I-10

HOUSING UNITS BY COUNTY AND CITY

Location	1970 ^{1/}	1980 ^{1/}	Percent Change ^{2/}	1970 Population Per Housing Unit ^{2/}	1980 Population Per Housing Unit ^{2/}
<u>Counties</u>					
McKinley	10,586	17,993	69.97	4.08	3.12
Sandoval	4,785	12,161	154.15	3.66	2.80
San Juan	14,960	29,524	97.35	3.51	2.74
Valencia	11,563	22,376	93.51	3.51	2.74
<u>Cities</u>					
Aztec	1,067	2,016	88.9	3.143	2.744
Bloomfield	432	1,771	310.0	3.644	2.730
Crownpoint	na ^{a/}	329 ^{3/}	--b/	--	3.453
Cuba	na	270	--	--	2.241
Farmington	6,874	11,882	72.9	3.197	2.610
Gallup	4,405	6,486	47.2	3.315	2.807
Grants	2,315	4,071	75.9	3.787	2.858
Milan	649	1,279	97.1	3.424	2.638
Shiprock	na	1,841 ^{3/}	--	--	3.926
Thoreau	na	301 ^{3/}	--	--	3.651
Tohatchi	na	295 ^{3/}	--	--	3.512
New Mexico Totals	326,128	505,700	55.06	3.12 (avg.)	2.56 (avg.)

Source: ^{1/} U.S. Department of Commerce, Bureau of the Census 1981:^{2/} Figures in these columns calculated by BLM New Mexico State Office personnel.^{3/} University of New Mexico, Bureau of Business and Economic Research 1980b.Notes: ^{a/} na = not available.^{b/} Dashes indicate that figures cannot be calculated.

APPENDIX I-11

SELECTED INFORMATION ON NON-FEDERAL PHYSICIANS IN NEW MEXICO, 1978-79

County	1978			1979		
	Population	Number	Population/Physician	Population	Number	Population/Physician
McKinley	56,100	31	1,810	59,100	26	2,273
Sandoval	24,000	18	1,333	25,000	16	1,562
San Juan	70,800	49	1,445	78,500	54	1,456
Valencia	51,400	19	2,705	56,500	20	2,825
New Mexico	1,190,000	1,737	685	1,241,000	1,814	684

Source: University of New Mexico 1978 and 1979a.

APPENDIX I-12

SELECTED CHARACTERISTICS OF MEDICAL SERVICE

County	Dentists		Nurses LPN ^{b/}		Nurses RNC/ ^{c/}	
	No. DDS FT/PT ^{a/}	Population/ Total DDS	No. LPN FT/PT	Population/ Employed LPN	No. RN FT/PT	Population/ Employed RN
McKinley	5	11,820	79	748	118	501
Sandoval	4	6,250	15	1,667	27	926
San Juan	22	3,568	106	741	138	569
Valencia	13	4,346	58	974	82	689
New Mexico	475	2,613	2,383	521	4,199	296

Source: University of New Mexico 1979.

Notes: ^{a/} FT/PT = full time, part time.
^{b/} LPN = licensed practical nurse.
^{c/} RN = registered nurse.

APPENDIX I-13

HOSPITALS AND HOSPITAL BEDS

County	1978 Number of Hospitals	1978 Beds	Beds/1,000 Pop.	1979 Pop/Bed
McKinley	5	344	6.9	172
Sandoval	0	0	0.0	---
San Juan	2	187	3.0	480
Valencia	2	68	1.3	831
New Mexico	53	4,696	4.1	264

Source: UNM 1979.

APPENDIX I-14

ADDITIONAL PRIMARY CARE, NONFEDERAL PHYSICIANS NEEDED IN NEW MEXICO 1979 and 1984

County	Estimated 1976 Population	Estimated 1984 Population	1979 PCNP	1979 Number of PCNP Needed ^{a/}	1979 Shortage ^{b/}	1984 Number of PCNP Needed ^{a/}	1984 Needed Minus 1979 PCNP ^{c/}
McKinley	54,375	61,000	16	45	29	51	35
Sandoval	23,771	34,600	12	20	8	29	17
San Juan	67,876	74,200	28	57	29	62	34
Valencia	48,614	57,400	22	41	19	48	26
New Mexico	1,169,606	1,386,500	779	975	196	1,155	376

Source: Bennett 1979.

Notes: ^{a/} Based upon a standard of 1,200 population per primary-care, nonfederal physician (PCNP).
^{b/} Column (4) minus column (3).
^{c/} Column (6) minus column (3).

AGE-ADJUSTED MORTALITY RATES BY SELECTED CAUSES, 1976-78 AVERAGE
(deaths per 100,000 population)

Location	Cirrhosis of the Liver		Suicide		Alcoholism	
	Male	Female	Male	Female	Male	Female
McKinley	41.7	24.7	58.8	9.9	76.8	33.5
Sandoval	32.4	2.7	23.6	15.5	72.2	7.3
San Juan	10.0	12.6	27.7	8.0	27.1	6.3
Valencia	29.7	3.1	49.9	3.9	20.5	9.0
New Mexico	22.6	10.4	32.8	9.2	24.5	6.7
United States	19.2	9.6	20.1	6.8	na	na

Source: New Mexico Health and Environment Department 1978.

Note: na = not available.

APPENDIX I-16

MOTOR VEHICLE ACCIDENTS AND DEATHS, 1976-79
(all roads and streets)

County	1976		1977		1978		1979	
	Accidents MVM	Deaths 100 MVM	Accidents MVM	Deaths 100 MVM	Accidents MVM	Deaths 100 MVM	Accidents MVM	Deaths 100 MVM
McKinley	4.78	13.96	4.43	12.08	4.94	11.73	4.90	12.32
Sandoval	5.27	10.40	1.75	7.82	2.22	8.72	1.98	6.75
San Juan	4.95	9.14	5.82	13.66	6.02	8.50	5.42	9.69
Valencia	2.81	7.45	2.80	8.43	3.06	6.12	3.09	7.10
New Mexico	4.53	5.24	4.53	6.04	4.84	5.74	4.67	5.72

Source: New Mexico Highway Department 1976-1979.

Note: MVM = million vehicle miles.

APPENDIX I-17

DISSOLUTION OF MARRIAGES BY COUNTY^{a/}

County	1975		1976		1977		1978	
	Number	Rate/1,000 Population	Number	Rate/1,000 Population	Number	Rate/1,000 Population	Number	Rate/1,000 Population
McKinley	166	3.2	154	2.8	156	2.8	172	3.1
Sandoval	102	4.5	118	5.0	154	6.4	93	3.8
San Juan	490	7.6	590	8.7	421	5.9	511	6.8
Valencia	325	7.0	319	6.5	454	8.8	348	6.5
New Mexico	8,413	7.4	9,128	7.8	9,143	7.7	9,608	7.9

Source: New Mexico Health and Environment Department 1978.

Note: ^{a/} Includes annulments and divorces.

APPENDIX I-18

NUMBER OF VIOLENT CRIMES, 1979

County	Murder	Forcible Rape	Robbery	Aggravated Assault	Total	Crimes per 1,000 Population	State Ranking	Percent Change From 1978
McKinley	5	46	110	249	410	7.23	5	1.57
Sandoval ^{a/}	2	6	9	49	66	2.63	25	1.22
San Juan	11	49	83	534	682	8.92	2	1.51
Valencia	6	21	43	189	259	4.71	11	0.36
New Mexico Totals	152	611	1,493	5,043	7,310	5.89	---	0.39
Change from 1978 Rates	26.3	41.9	19.6	19.4	10.4	---	---	---

Source: New Mexico State Police 1980.

Note: ^{a/} No reports received from certain reporting units.

APPENDIX I-19

NUMBER OF MAJOR PROPERTY CRIMES, 1979

County	Burglary	Larceny	Motor Vehicle Theft	Total	Crimes per 1,000 Population	Percent Change from 1978	State Ranking
McKinley	465	1,254	180	1,899	33.49	0.43	20
Sandoval ^{a/}	252	238	28	518	20.61	12.45	28
San Juan	798	2,575	282	3,655	47.83	9.79	6
Valencia	814	1,209	144	2,167	39.43	0.61	11
New Mexico Totals	17,935	40,263	4,161	62,352	50.24	3.94	---

Source: New Mexico State Police 1980.

Note: ^{a/} No reports received from certain reporting units.

CHARACTERISTICS BY SCHOOL DISTRICT

County/School District	Attrition Rate 1976-1980 ^{1/} (Percent)	Pupil Teacher Ratio ^{2/} 1977-1978	Mobility Rate
McKinley			
Gallup	33.2	18.8	26.9
Sandoval			
Cuba	46.8	17.8	26.8
Jemez Springs	37.5	15.5	8.4
San Juan			
Aztec	8.3	19.1	39.2
Bloomfield	27.7	21.1	27.5
Central	30.1	19.9	29.0
Farmington	30.8	20.5	38.6
Valencia			
Grants	31.1	20.4	36.4
New Mexico	27.4	19.9	26.1

Sources: ^{1/} New Mexico Department of Education, New Mexico Superintendent of Public Instruction 1979 to 1980.
^{2/} New Mexico Department of Education 1979.

GLOSSARY

ACTIVITY OCCASIONS. One person participating in one recreation activity during 12 or more hours of one day.

ALLOTMENT. An area of land designated and managed for grazing of livestock.

ALLUVIUM. Unconsolidated geologic material deposited by water; usually contains and transmits water.

ALLOTMENT MANAGEMENT PLAN (AMP). A documented program which applies to livestock operations on the public lands, which is prepared in consultation with the permittee(s) or lessee(s) involved, and which: (1) prescribes the manner in and extent to which livestock operations will be conducted in order to meet the multiple-use, sustained-yield, economic, and other needs and objectives as determined for the public lands through land use planning; and (2) describes the type, location, ownership, and general specifications for the range improvements to be installed and maintained on the public lands to meet the livestock grazing and other objectives of land management; (3) contains such other provisions relating to livestock grazing and other objectives as may be prescribed by the authorized officer consistent with applicable law.

AMPHIPOD. A crustacean of a large group comprising the sand fleas and allied forms.

ANIMAL UNIT MONTH (AUM). The amount of forage required to sustain the equivalent of one cow, one horse, two elk, three Barbary sheep, five domestic sheep, five goats, five deer or ten antelope for one month.

AQUIFER. A rock formation containing water and capable of transmitting it to a well.

ARTESIAN. Pressure on water in a rock formation caused by confinement under overlying, impermeable formations.

ARTHROPOD. Animals with articulated body and limbs, including spiders insects and crustaceans.

BRITISH THERMAL UNIT (BTU). The heat needed to raise one pound of water 1°F. A Btu is equal to 252 calories.

BULK TRUCK. A truck carrying a large volume of material.

CARRYING CAPACITY. The number of a given species of animal that a specific area of land can sustain over a given period of time.

CASED. A cased drillhole is one which has had casing applied to it. Casing consists of a heavy metal pipe or tubing that is lowered into a drillhole during or after drilling in order to support the sides of the hole. This prevents the walls from caving, prevents loss of drilling mud into the ground, and prevents water, gas, or other fluid from entering the hole.

COOL-SEASON PLANT. A plant that makes the major portion of its growth during late winter, early spring, and again in the fall (during the cool seasons).

DECAPOD. One of the largest order of crustaceans, including shrimps, crayfish, and allies, characterized by having five pairs of legs.

DIPTEROUS. Belonging to an order of insects comprising the true or winged flies (with the exceptions of wingless parasite forms) having two wings and a posterior pair of small club-shaped organs (halteres).

DRAWDOWN. A reduction in the water level of a rock formation caused by withdrawal of water from the formation by wells.

EPHEMERAL STREAM. A stream that flows only in response to a storm event.

FLOODPLAIN. A relatively flat area of stream - laid deposits subject to repeated flooding.

FLOW-DURATION CURVE. A graphic representation of streamflow; depicts the percent of time that a given flow is equalled or exceeded.

IMPERMEABLE STRATUM. A layer of rock that does not allow water to pass through it.

LENTICULAR. A body of ore or of rock thick in the middle and thin at the edges, similiar to a double convex lens.

LOGICAL MINING UNIT (LMU). A block of land identified by the USGS as being appropriate for mining as a single unit.

MANAGEMENT FRAMEWORK PLAN (MFP). Land use plan for public lands which provides a set of goals, objectives, and constraints for a specific planning area to guide the development of detailed plans for the management of each resource.

MORPHOLOGICAL. The features, collectively comprised in the form and structure of an organism or any of its parts.

OUTCROP, COAL CROP. That part of a geologic formation or structure that appears at the surface of the earth. An outcrop containing a coal bed can be referred to as a coal crop.

OVERBURDEN, INTERBURDEN. Barren rock material, usually unconsolidated, overlying a mineral deposit and which must be removed prior to mining.

PASSERINE. Of an order (Passeriformes) of birds consisting primarily of songbirds of perching habits ranging from titmice to ravens and birds of paradise and including more than half of all birds.

PERENNIAL STREAM. A stream that flows all year.

POROSITY. The amount of open pore space in a consolidated or unconsolidated geologic formation.

RANGE CONDITION (ECOLOGICAL). The present state of vegetation of a range site in relation to the climax (natural potential) plant community for that site. It is an expression of the relative degree to which the kinds, proportions, and amounts of plants in a plant community resemble that of the climax plant community for the site. Range condition is basically an ecological rating of the plant community. Four classes are used to express the degree to which the composition of the present plant community reflects that of the climax. They are:

<u>Range condition class</u>	<u>Percentage of present plant community that is climax for the range site.</u>
Excellent.	76-100
Good	51-75
Fair	26-50
Poor	0-25

RANK. A coal classification based on the degree of change in molecular structure of the coal, caused by great heat or pressure (metamorphism). There are four major ranks. The lowest rank, lignite, is the least metamorphosed while the highest rank, anthracite, is the most highly metamorphosed. Subbituminous is the rank just above lignite, with bituminous ranked above subbituminous. Ranking is determined by the number of Btu's in one pound of the coal being classified. The letter A, B, or C after a rank classification is subdivision within that rank.

RIPARIAN. Pertaining to, or living on, the bank of a river, a lake, or tidewater. May also include temporary waters, generally refers to vegetation.

SCRAPE. A term for a nest site characteristic of raptor birds; usually consists of a depressed, cleared area in cliffs and ledges.

SEAM. A thin layer or stratum of rock separating two distinctive layers of different composition.

SECTION 3 ADMINISTRATION. Applies to public lands within grazing district boundaries that are administered in accordance with Section 3 of the Taylor Grazing Act.

SECTION 15 ADMINISTRATION. Applies to public lands outside grazing district boundaries that are administered in accordance with Section 15 of the Taylor Grazing Act.

SHOTHOLE. In seismic prospecting, the borehole in which an explosive is placed for blasting.

SOIL BOITA. All the microorganisms, fauna and flora associated on and within the soil horizons.

SPOILS. . Waste rock material generated by surface mining. Spoils are regraded to approximate the pre-mining topography as part of the reclamation effort.

STRIKE. The direction or trend that a bedding or fault plane takes as it intersects the horizontal.

SURFACE EXPRESSION. The indication of a subsurface geologic feature on the earth's surface.

TERTIARY SANDSTONES. Sandstones of Tertiary geologic age. In San Juan Basin, these are the Ojo Alamo, Nacimiento, Animas, and San Jose formations.

TILTH. The physical condition of the soil as related to its ease of tillage, fitness as a seedbed, and its impedance to seedling emergence and root penetration.

UTILIZATION. The proportion of current year's forage production that is consumed or destroyed by grazing animals, usually expressed as a percentage.

VIGOR. The state of health of a plant. The capacity of a plant to respond to growing conditions, to make and store food, produce food, produce seed, or reproduce vegetatively, that is, by stolons or rhizomes.

VOLATILE. Changing readily to vapor.

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